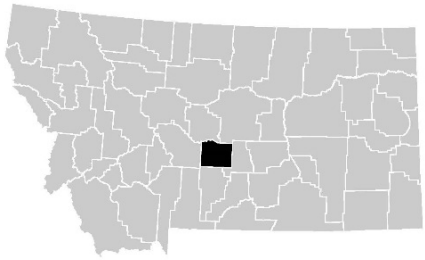
FLOOD INSURANCE STUDY

FEDERAL EMERGENCY MANAGEMENT AGENCY

VOLUME 1 OF 1



WHEATLAND COUNTY, MONTANA

AND INCORPORATED AREAS

COMMUNITY NAME	COMMUNITY NUMBER
HARLOWTON, CITY OF	300175
JUDITH GAP, TOWN OF*	300136
WHEATLAND COUNTY UNINCORPORATED AREAS	300172

*No Special Flood Hazard Areas Identified

FEMA

EFFECTIVE:

PRELIMINARY 5/15/2018

FLOOD INSURANCE STUDY NUMBER
30107CV000A

Version Number 2.3.3.2

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FLOOD INSURANCE STUDY REPORT
WHEATLAND COUNTY, MONTANA

SECTION 1.0 – INTRODUCTION

1.1 The National Flood Insurance Program

The National Flood Insurance Program (NFIP) is a voluntary Federal program that enables property owners in participating communities to purchase insurance protection against losses from flooding. This insurance is designed to provide an alternative to disaster assistance to meet the escalating costs of repairing damage to buildings and their contents caused by floods.

For decades, the national response to flood disasters was generally limited to constructing flood-control works such as dams, levees, sea-walls, and the like, and providing disaster relief to flood victims. This approach did not reduce losses nor did it discourage unwise development. In some instances, it may have actually encouraged additional development. To compound the problem, the public generally could not buy flood coverage from insurance companies, and building techniques to reduce flood damage were often overlooked.

In the face of mounting flood losses and escalating costs of disaster relief to the general taxpayers, the U.S. Congress created the NFIP. The intent was to reduce future flood damage through community floodplain management ordinances, and provide protection for property owners against potential losses through an insurance mechanism that requires a premium to be paid for the protection.

The U.S. Congress established the NFIP on August 1, 1968, with the passage of the National Flood Insurance Act of 1968. The NFIP was broadened and modified with the passage of the Flood Disaster Protection Act of 1973 and other legislative measures. It was further modified by the National Flood Insurance Reform Act of 1994 and the Flood Insurance Reform Act of 2004. The NFIP is administered by the Federal Emergency Management Agency (FEMA), which is a component of the Department of Homeland Security (DHS).

Participation in the NFIP is based on an agreement between local communities and the Federal Government. If a community adopts and enforces floodplain management regulations to reduce future flood risks to new construction and substantially improved structures in Special Flood Hazard Areas (SFHAs), the Federal Government will make flood insurance available within the community as a financial protection against flood losses. The community's floodplain management regulations must meet or exceed criteria established in accordance with Title 44 Code of Federal Regulations (CFR) Part 60, Criteria for Land Management and Use.

SFHAs are delineated on the community's Flood Insurance Rate Maps (FIRMs). Under the NFIP, buildings that were built before the flood hazard was identified on the community's FIRMs are generally referred to as "Pre-FIRM" buildings. When the NFIP was created, the U.S. Congress recognized that insurance for Pre-FIRM buildings would be prohibitively expensive if the premiums were not subsidized by the Federal Government. Congress also recognized that most of these floodprone buildings were built by individuals who did not have sufficient knowledge of the flood hazard to make informed decisions. The NFIP requires that full actuarial rates reflecting the complete flood risk be charged on all buildings constructed or substantially improved on or after

the effective date of the initial FIRM for the community or after December 31, 1974, whichever is later. These buildings are generally referred to as "Post-FIRM" buildings.

1.2 Purpose of this Flood Insurance Study Report

This Flood Insurance Study (FIS) Report revises and updates information on the existence and severity of flood hazards for the study area. The studies described in this report developed flood hazard data that will be used to establish actuarial flood insurance rates and to assist communities in efforts to implement sound floodplain management.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive than the minimum Federal requirements. Contact your State NFIP Coordinator to ensure that any higher State standards are included in the community's regulations.

1.3 Jurisdictions Included in the Flood Insurance Study Project

This FIS Report covers the entire geographic area of Wheatland County, Montana.

The jurisdictions that are included in this project area, along with the Community Identification Number (CID) for each community and the United States Geological Survey (USGS) 8-digit Hydrologic Unit Code (HUC-8) sub-basins affecting each, are shown in Table 1. The FIRM panel numbers that affect each community are listed. If the flood hazard data for the community is not included in this FIS Report, the location of that data is identified.

Table 1: Listing of NFIP Jurisdictions

Community	CID	HUC-8 Sub-Basin(s)	Located on FIRM Panel(s)	If Not Included, Location of Flood Hazard Data
Harlowton, City of	300175	10040201	30107C0528C[1] 30107C0529C 30107C0536C 30107C0537C	
Judith Gap, Town of	300136	10040201	30107C0150C[1] 30107C0175C[1]	
Wheatland County Unincorporated Areas	300172	10040103 10040201	30107C0025C[1] 30107C0050C[1] 30107C0075C[1] 30107C0100C[1]	

[1] Panel Not Printed

Table 1: Listing of NFIP Jurisdictions - continued

Community	CID	HUC-8 Sub-Basin(s)	Located on FIRM Panel(s)	If Not Included, Location of Flood Hazard Data
Wheatland County Unincorporated Areas	300172	10040103 10040201	30107C0125C[1] 30107C0150C[1] 30107C0175C[1] 30107C0200C[1] 30107C0225C[1] 30107C0250C[1] 30107C0275C[1] 30107C0300C[1] 30107C0325C[1] 30107C0350C[1] 30107C0375C[1] 30107C0400C[1] 30107C0425C[1] 30107C0450C 30107C0475C 30107C0500C 30107C0505C[1] 30107C0509C 30107C0510C 30107C0515C[1] 30107C0517C 30107C0520C 30107C0528C[1] 30107C0529C 30107C0530C 30107C0533C 30107C0535C 30107C0536C 30107C0537C 30107C0540C[1] 30107C0541C 30107C0545C 30107C0565C 30107C0570C 30107C0575C[1] 30107C0580C[1] 30107C0585C 30107C0590C 30107C0595C[1] 30107C0605C	

[1] Panel Not Printed

Table 1: Listing of NFIP Jurisdictions - continued

Community	CID	HUC-8 Sub-Basin(s)	Located on FIRM Panel(s)	If Not Included, Location of Flood Hazard Data
Wheatland County Unincorporated Areas	300172	10040103 10040201	30107C0625C[1] 30107C0650C[1] 30107C0675C[1] 30107C0700C 30107C0725C[1] 30107C0750C[1] 30107C0760C[1] 30107C0775C[1] 30107C0780C 30107C0785C 30107C0800C[1] 30107C0805C 30107C0810C 30107C0815C 30107C0820C 30107C0850C[1] 30107C0875C[1] 30107C0900C[1] 30107C0925C[1] 30107C0950C[1] 30107C0975C[1] 30107C1000C[1] 30107C1025C[1]	

[1] Panel Not Printed

1.4 Considerations for using this Flood Insurance Study Report

The NFIP encourages State and local governments to implement sound floodplain management programs. To assist in this endeavor, each FIS Report provides floodplain data, which may include a combination of the following: 10-, 4-, 2-, 1-, and 0.2-percent annual chance flood elevations (the 1% annual chance flood elevation is also referred to as the Base Flood Elevation (BFE)); delineations of the 1% annual chance and 0.2% annual chance floodplains; and 1% annual chance floodway. This information is presented on the FIRM and/or in many components of the FIS Report, including Flood Profiles, Floodway Data tables, Summary of Non-Coastal Stillwater Elevations tables, and Coastal Transect Parameters tables (not all components may be provided for a specific FIS).

This section presents important considerations for using the information contained in this FIS Report and the FIRM, including changes in format and content. Figures 1, 2, and 3 present information that applies to using the FIRM with the FIS Report.

- Part or all of this FIS Report may be revised and republished at any time. In addition, part of this FIS Report may be revised by a Letter of Map Revision (LOMR), which does not

involve republication or redistribution of the FIS Report. Refer to Section 6.5 of this FIS Report for information about the process to revise the FIS Report and/or FIRM.

It is, therefore, the responsibility of the user to consult with community officials by contacting the community repository to obtain the most current FIS Report components. Communities participating in the NFIP have established repositories of flood hazard data for floodplain management and flood insurance purposes. Community map repository addresses are provided in Table 31, "Map Repositories," within this FIS Report.

- New FIS Reports are frequently developed for multiple communities, such as entire counties. A countywide FIS Report incorporates previous FIS Reports for individual communities and the unincorporated area of the county (if not jurisdictional) into a single document and supersedes those documents for the purposes of the NFIP.

  The initial Countywide FIS Report for Wheatland County became effective on [TBD]. Refer to Table 28 for information about subsequent revisions to the FIRMs.

- Selected FIRM panels for the community may contain information (such as floodways and cross sections) that was previously shown separately on the corresponding Flood Boundary and Floodway Map (FBFM) panels. In addition, former flood hazard zone designations have been changed as follows:

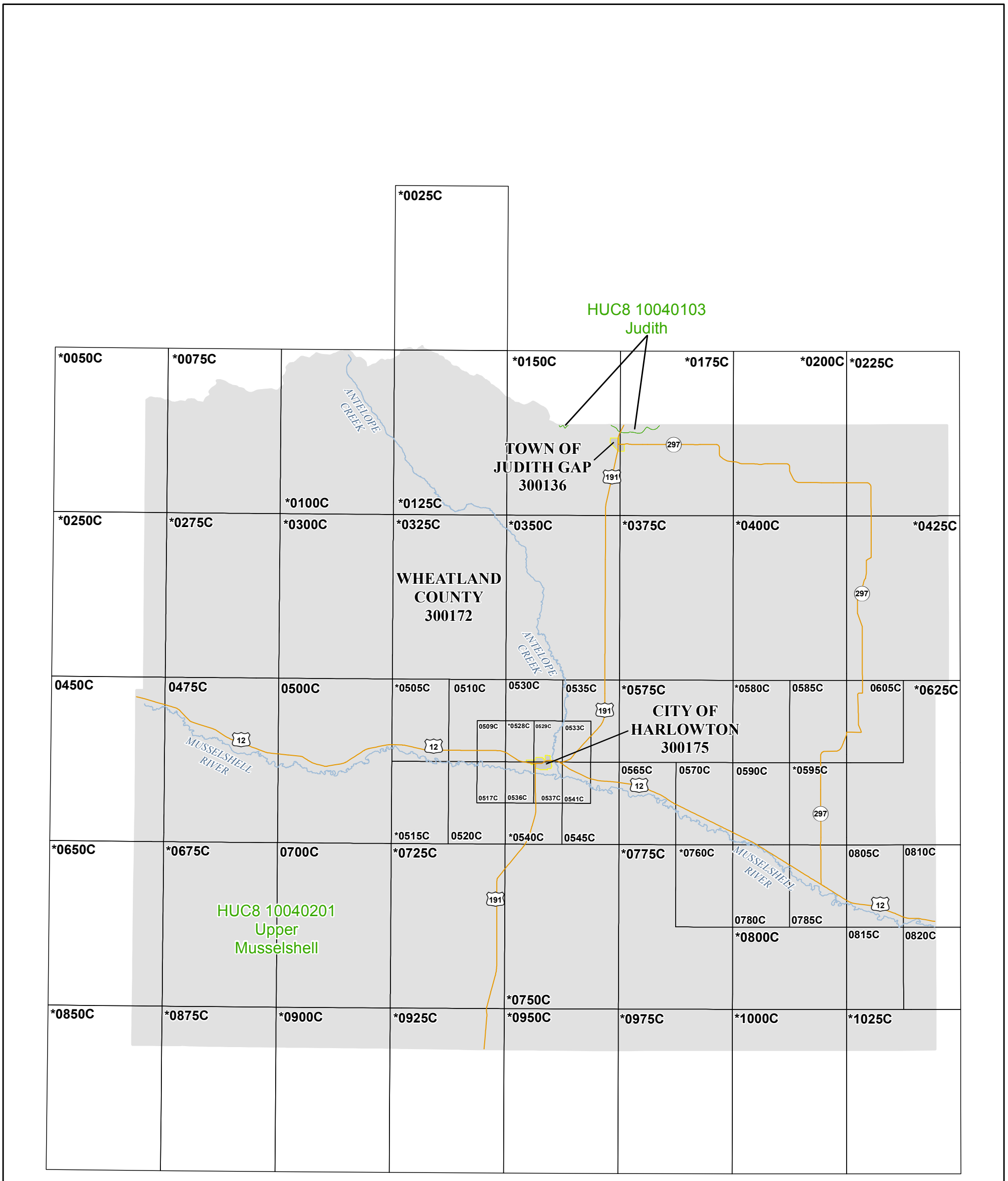
Old Zone	New Zone
A1 through A30	AE
V1 through V30	VE
B	X (shaded)
C	X (unshaded)

- The CRS is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements. Visit the FEMA Web site at www.fema.gov/national-flood-insurance-program-community-rating-system or contact your appropriate FEMA Regional Office for more information about this program.

- FEMA has developed a *Guide to Flood Maps* (FEMA 258) and online tutorials to assist users in accessing the information contained on the FIRM. These include how to read panels and step-by-step instructions to obtain specific information. To obtain this guide and other assistance in using the FIRM, visit the FEMA Web site at www.fema.gov/online-tutorials.

The FIRM Index in Figure 1 shows the overall FIRM panel layout within Wheatland County, and also displays the panel number and effective date for each FIRM panel in the county. Other information shown on the FIRM Index includes community boundaries, watershed boundaries, and USGS HUC-8 codes.

Figure 1: FIRM Index



N

1 inch = 26,667 feet 1 : 320,000

Feet

0 7,500 15,000 30,000 45,000 60,000

Map Projection:
NAD 1983 StatePlane Montana FIPS 2500 Feet;
Western Hemisphere; Vertical Datum: NAVD 88

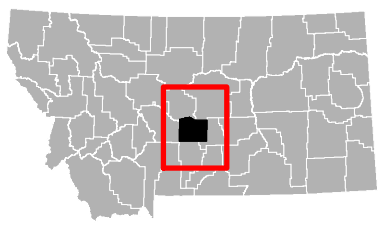
THE INFORMATION DEPICTED ON THIS MAP AND SUPPORTING DOCUMENTATION ARE ALSO AVAILABLE IN DIGITAL FORMAT AT

HTTP://MSC.FEMA.GOV

SEE FLOOD INSURANCE STUDY FOR ADDITIONAL INFORMATION

* PANEL NOT PRINTED - AREAS ALL IN ZONE D

COUNTY LOCATOR



NATIONAL FLOOD INSURANCE PROGRAM

FLOOD INSURANCE RATE MAP INDEX

WHEATLAND COUNTY, MONTANA and Incorporated Areas

PANELS PRINTED:

0450, 0475, 0500, 0509, 0510, 0517, 0520, 0529, 0530, 0533, 0535, 0536, 0537, 0541, 0545, 0565, 0570, 0585, 0590, 0605, 0700, 0780, 0785, 0805, 0810, 0815, 0820

PRELIMINARY
5/15/2018

FEMA

MAP NUMBER
30107CIND0A

EFFECTIVE DATE

Each FIRM panel may contain specific notes to the user that provide additional information regarding the flood hazard data shown on that map. However, the FIRM panel does not contain enough space to show all the notes that may be relevant in helping to better understand the information on the panel. Figure 2 contains the full list of these notes.

Figure 2: FIRM Notes to Users

NOTES TO USERS

For information and questions about this map, available products associated with this FIRM including historic versions of this FIRM, how to order products, or the National Flood Insurance Program in general, please call the FEMA Map Information eXchange at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA Flood Map Service Center website at msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the website. Users may determine the current map date for each FIRM panel by visiting the FEMA Flood Map Service Center website or by calling the FEMA Map Information eXchange.

Communities annexing land on adjacent FIRM panels must obtain a current copy of the adjacent panel as well as the current FIRM Index. These may be ordered directly from the Flood Map Service Center at the number listed above.

For community and countywide map dates, refer to Table 28 in this FIS Report.

To determine if flood insurance is available in the community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

PRELIMINARY FIS REPORT: FEMA maintains information about map features, such as street locations and names, in or near designated flood hazard areas. Requests to revise information in or near designated flood hazard areas may be provided to FEMA during the community review period, at the final Consultation Coordination Officer's meeting, or during the statutory 90-day appeal period. Approved requests for changes will be shown on the final printed FIRM.

The map is for use in administering the NFIP. It may not identify all areas subject to flooding, particularly from local drainage sources of small size. Consult the community map repository to find updated or additional flood hazard information.

BASE FLOOD ELEVATIONS: For more detailed information in areas where Base Flood Elevations (BFEs) and/or floodways have been determined, consult the Flood Profiles and Floodway Data and/or Summary of Non-Coastal Stillwater Elevations tables within this FIS Report. Use the flood elevation data within the FIS Report in conjunction with the FIRM for construction and/or floodplain management.

FLOODWAY INFORMATION: Boundaries of the floodways were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the FIS Report for this jurisdiction.

Figure 2. FIRM Notes to Users

FLOOD CONTROL STRUCTURE INFORMATION: Certain areas not in Special Flood Hazard Areas may be protected by flood control structures. Refer to Section 4.3 "Non-Levee Flood Protection Measures" of this FIS Report for information on flood control structures for this jurisdiction.

PROJECTION INFORMATION: The projection used in the preparation of the map was the North American Datum of 1983 (NAD 1983) State Plane Montana FIPS 2500 Feet. Differences in datum, spheroid, projection or State Plane zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of the FIRM.

ELEVATION DATUM: Flood elevations on the FIRM are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988**,** visit the National Geodetic Survey website at www.ngs.noaa.gov.

Local vertical monuments may have been used to create the map. To obtain current monument information, please contact the appropriate local community listed in Table 31 of this FIS Report.

BASE MAP INFORMATION: Base map information shown on the FIRM was provided by Montana State Library, Federal Emergency Management Agency, and the National Agriculture Imagery Program (NAIP). Ortho imagery was provided by NAIP in 2013, and has a 1 meter ground resolution. For information about base maps, refer to Section 6.2 “Base Map” in this FIS Report.

The map reflects more detailed and up-to-date stream channel configurations than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables may reflect stream channel distances that differ from what is shown on the map.

Corporate limits shown on the map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after the map was published, map users should contact appropriate community officials to verify current corporate limit locations.

NOTES FOR FIRM INDEX

REVISIONS TO INDEX: As new studies are performed and FIRM panels are updated within Wheatland County, MT, corresponding revisions to the FIRM Index will be incorporated within the FIS Report to reflect the effective dates of those panels. Please refer to Table 28 of this FIS Report to determine the most recent FIRM revision date for each community. The most recent FIRM panel effective date will correspond to the most recent index date.

SPECIAL NOTES FOR SPECIFIC FIRM PANELS

This Notes to Users section was created specifically for Wheatland County, MT**,** effective [TBD].

Figure 2. FIRM Notes to Users

FLOOD RISK REPORT: A Flood Risk Report (FRR) may be available for many of the flooding sources and communities referenced in this FIS Report. The FRR is provided to increase public awareness of flood risk by helping communities identify the areas within their jurisdictions that have the greatest risks. Although non-regulatory, the information provided within the FRR can assist communities in assessing and evaluating mitigation opportunities to reduce these risks. It can also be used by communities developing or updating flood risk mitigation plans. These plans allow communities to identify and evaluate opportunities to reduce potential loss of life and property. However, the FRR is not intended to be the final authoritative source of all flood risk data for a project area; rather, it should be used with other data sources to paint a comprehensive picture of flood risk.

Each FIRM panel contains an abbreviated legend for the features shown on the maps. However, the FIRM panel does not contain enough space to show the legend for all map features. Figure 3 shows the full legend of all map features. Note that not all of these features may appear on the FIRM panels in Wheatland County.

Figure 3: Map Legend for FIRM

SPECIAL FLOOD HAZARD AREAS: *The 1% annual chance flood, also known as the base flood or 100-year flood, has a 1% chance of happening or being exceeded each year. Special Flood Hazard Areas are subject to flooding by the 1% annual chance flood. The Base Flood Elevation is the water surface elevation of the 1% annual chance flood. The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights. See note for specific types. If the floodway is too narrow to be shown, a note is shown.*

	Special Flood Hazard Areas subject to inundation by the 1% annual chance flood (Zones A, AE, AH, AO, AR, A99, V and VE)
Zone A	The flood insurance rate zone that corresponds to the 1% annual chance floodplains. No base (1% annual chance) flood elevations (BFEs) or depths are shown within this zone.
Zone AE	The flood insurance rate zone that corresponds to the 1% annual chance floodplains. Base flood elevations derived from the hydraulic analyses are shown within this zone.
Zone AH	The flood insurance rate zone that corresponds to the areas of 1% annual chance shallow flooding (usually areas of ponding) where average depths are between 1 and 3 feet. Whole-foot BFEs derived from the hydraulic analyses are shown at selected intervals within this zone.
Zone AO	The flood insurance rate zone that corresponds to the areas of 1% annual chance shallow flooding (usually sheet flow on sloping terrain) where average depths are between 1 and 3 feet. Average whole-foot depths derived from the hydraulic analyses are shown within this zone.
Zone AR	The flood insurance rate zone that corresponds to areas that were formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
Zone A99	The flood insurance rate zone that corresponds to areas of the 1% annual chance floodplain that will be protected by a Federal flood protection system where construction has reached specified statutory milestones. No base flood elevations or flood depths are shown within this zone.
Zone V	The flood insurance rate zone that corresponds to the 1% annual chance coastal floodplains that have additional hazards associated with storm waves. Base flood elevations are not shown within this zone.
Zone VE	Zone VE is the flood insurance rate zone that corresponds to the 1% annual chance coastal floodplains that have additional hazards associated with storm waves. Base flood elevations derived from the coastal analyses are shown within this zone as static whole-foot elevations that apply throughout the zone.

Figure 3: Map Legend for FIRM

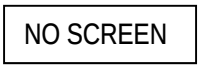
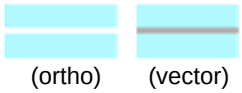
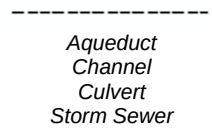
	Regulatory Floodway determined in Zone AE.
	Non-encroachment zone (see Section 2.4 of this FIS Report for more information)
OTHER AREAS OF FLOOD HAZARD	
	Shaded Zone X: Areas of 0.2% annual chance flood hazards and areas of 1% annual chance flood hazards with average depths of less than 1 foot or with drainage areas less than 1 square mile.
	Future Conditions 1% Annual Chance Flood Hazard – Zone X: The flood insurance rate zone that corresponds to the 1% annual chance floodplains that are determined based on future-conditions hydrology. No base flood elevations or flood depths are shown within this zone.
	Area with Reduced Flood Risk due to Levee: Areas where an accredited levee, dike, or other flood control structure has reduced the flood risk from the 1% annual chance flood.
	Area with Flood Risk due to Levee: Areas where a non-accredited levee, dike, or other flood control structure is shown as providing protection to less than the 1% annual chance flood.
OTHER AREAS	
	Zone D (Areas of Undetermined Flood Hazard): The flood insurance rate zone that corresponds to unstudied areas where flood hazards are undetermined, but possible.
	Unshaded Zone X: Areas of minimal flood hazard.
FLOOD HAZARD AND OTHER BOUNDARY LINES	
	Flood Zone Boundary (white line on ortho-photography-based mapping; gray line on vector-based mapping)
	Limit of Study
	Jurisdiction Boundary
	Limit of Moderate Wave Action (LiMWA): Indicates the inland limit of the area affected by waves greater than 1.5 feet
GENERAL STRUCTURES	
	Channel, Culvert, Aqueduct, or Storm Sewer

Figure 3: Map Legend for FIRM

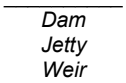
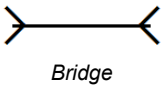
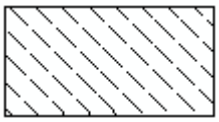
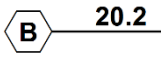
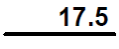
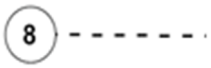
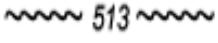
	Dam, Jetty, Weir
	Non-accredited Levee, Dike, or Floodwall
	Bridge
COASTAL BARRIER RESOURCES SYSTEM (CBRS) AND OTHERWISE PROTECTED AREAS (OPA): *CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.*	
	Coastal Barrier Resources System Area: Labels are shown to clarify where this area shares a boundary with an incorporated area or overlaps with the floodway.
	Otherwise Protected Area
REFERENCE MARKERS	
	River mile Markers
CROSS SECTION & TRANSECT INFORMATION	
	Lettered Cross Section with Regulatory Water Surface Elevation (BFE)
	Numbered Cross Section with Regulatory Water Surface Elevation (BFE)
	Unlettered Cross Section with Regulatory Water Surface Elevation (BFE)
	Coastal Transect
	Profile Baseline: Indicates the modeled flow path of a stream and is shown on FIRM panels for all valid studies with profiles or otherwise established base flood elevation.
	Coastal Transect Baseline: Used in the coastal flood hazard model to represent the 0.0-foot elevation contour and the starting point for the transect and the measuring point for the coastal mapping.
	Base Flood Elevation Line

Figure 3: Map Legend for FIRM

513	Base Flood Elevation Line
ZONE AE (EL 16)	Static Base Flood Elevation value (shown under zone label)
ZONE AO (DEPTH 2)	Zone designation with Depth
ZONE AO (DEPTH 2) (VEL 15 FPS)	Zone designation with Depth and Velocity
BASE MAP FEATURES	
Missouri Creek	River, Stream or Other Hydrographic Feature
234	Interstate Highway
234	U.S. Highway
234	State Highway
234	County Highway
MAPLE LANE	Street, Road, Avenue Name, or Private Drive if shown on Flood Profile
RAILROAD	Railroad
	Horizontal Reference Grid Line
	Horizontal Reference Grid Ticks
+	Secondary Grid Crosshairs
Land Grant	Name of Land Grant
7	Section Number
R. 43 W. T. 22 N.	Range, Township Number
$^{42}76^{000m}$E	Horizontal Reference Grid Coordinates (UTM)
365000 FT	Horizontal Reference Grid Coordinates (State Plane)
80° 16’ 52.5”	Corner Coordinates (Latitude, Longitude)

SECTION 2.0 – FLOODPLAIN MANAGEMENT APPLICATIONS

2.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1% annual chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2% annual chance (500-year) flood is employed to indicate additional areas of flood hazard in the community.

Each flooding source included in the project scope has been studied and mapped using professional engineering and mapping methodologies that were agreed upon by FEMA and Wheatland County as appropriate to the risk level. Flood risk is evaluated based on factors such as known flood hazards and projected impact on the built environment. Engineering analyses were performed for each studied flooding source to calculate its 1% annual chance flood elevations; elevations corresponding to other floods (e.g. 10-, 4-, 2-, 0.2-percent annual chance, etc.) may have also been computed for certain flooding sources. Engineering models and methods are described in detail in Section 5.0 of this FIS Report. The modeled elevations at cross sections were used to delineate the floodplain boundaries on the FIRM; between cross sections, the boundaries were interpolated using elevation data from various sources. More information on specific mapping methods is provided in Section 6.0 of this FIS Report.

Depending on the accuracy of available topographic data (Table 23), study methodologies employed (Section 5.0), and flood risk, certain flooding sources may be mapped to show both the 1% and 0.2% annual chance floodplain boundaries, regulatory water surface elevations (BFEs), and/or a regulatory floodway. Similarly, other flooding sources may be mapped to show only the 1% annual chance floodplain boundary on the FIRM, without published water surface elevations. In cases where the 1% and 0.2% annual chance floodplain boundaries are close together, only the 1% annual chance floodplain boundary is shown on the FIRM. Figure 3, "Map Legend for FIRM", describes the flood zones that are used on the FIRMs to account for the varying levels of flood risk that exist along flooding sources within the project area. Table 2 and Table 3 indicate the flood zone designations for each flooding source and each community within Wheatland County, respectively.

Table 2, "Flooding Sources Included in this FIS Report," lists each flooding source, including its study limits, affected communities, mapped zone on the FIRM, and the completion date of its engineering analysis from which the flood elevations on the FIRM and in the FIS Report were derived. Descriptions and dates for the latest hydrologic and hydraulic analyses of the flooding sources are shown in Table 13. Floodplain boundaries for these flooding sources are shown on the FIRM (published separately) using the symbology described in Figure 3. On the map, the 1% annual chance floodplain corresponds to the SFHAs. The 0.2% annual chance floodplain shows areas that, although out of the regulatory floodplain, are still subject to flood hazards.

Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data. The procedures to remove these areas from the SFHA are described in Section 6.5 of this FIS Report.

Table 2: Flooding Sources Included in this FIS Report

Flooding Source	Community	Downstream Limit	Upstream Limit	HUC-8 Sub-Basin(s)	Length (mi) (streams or coastlines)	Area (mi^2) (estuaries or ponding)	Floodway (Y/N)	Zone shown on FIRM	Date of Analysis
Antelope Creek	Wheatland County Unincorporated Areas	Confluence with the Musselshell River near Harlowton, MT	Approximately stream mile 4.2	10040201	3.9	N/A	Y[1]	AE, AE with Floodway	2016
Antelope Overflow	Harlowton, City of; Wheatland County Unincorporated Areas	Confluence with Antelope Creek near Harlowton, MT	Point of diversion from Antelope Creek near Harlowton, MT	10040201	0.8	N/A	Y	AE with Floodway	2016
Harlowton Overflow Channel	Harlowton, City of; Wheatland County Unincorporated Areas	Confluence with the Musselshell River near Harlowton, MT	Point of diversion from the Musselshell River west of Harlowton, MT	10040201	2.9	N/A	N	AE	2016
Musselshell River	Wheatland County Unincorporated Areas	Wheatland County, MT eastern county line	River mile 45	10040201	45.4	N/A	Y[1]	AE, AE with Floodway	2016
Railroad Split	Wheatland County Unincorporated Areas	Red Bridge Road near Harlowton, MT	Point of diversion from Antelope Creek near Harlowton, MT	10040201	0.7	N/A	Y	AE with Floodway	2016

[1] Floodways computed for the detailed study reaches in the Town of Harlowton (Reaches 9 and 10).

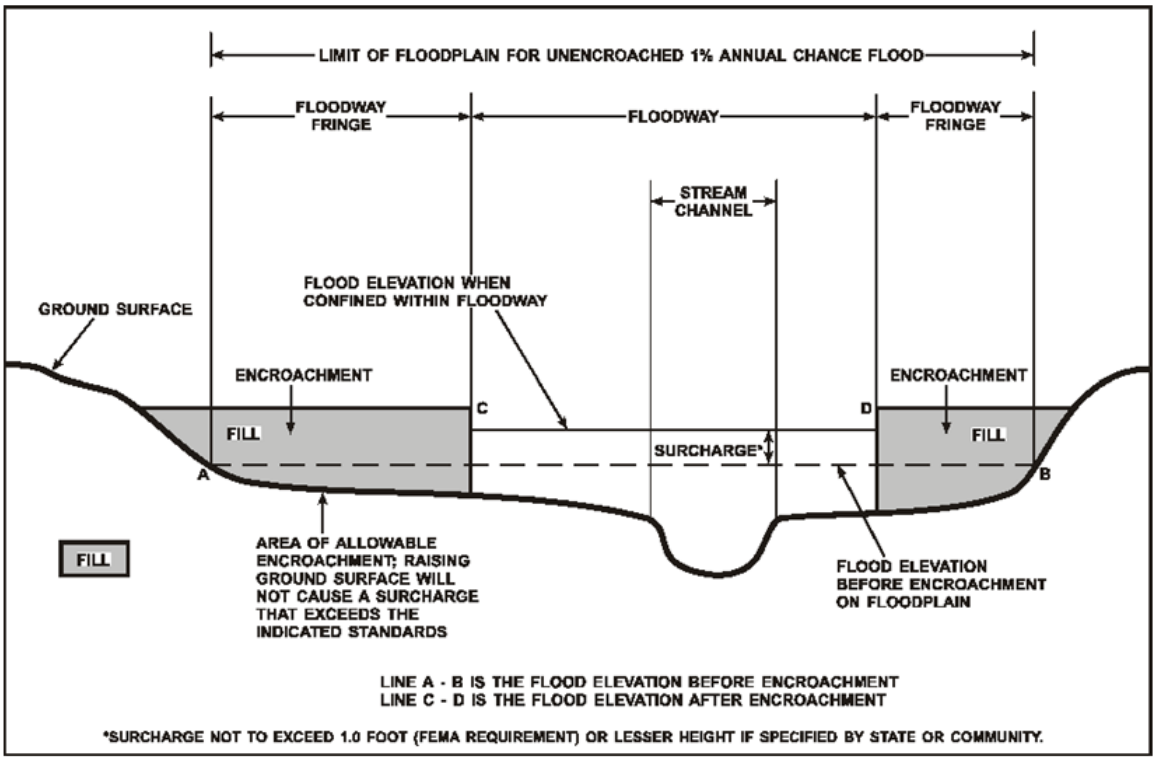
2.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard.

For purposes of the NFIP, a floodway is used as a tool to assist local communities in balancing floodplain development against increasing flood hazard. With this approach, the area of the 1% annual chance floodplain on a river is divided into a floodway and a floodway fringe based on hydraulic modeling. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment in order to carry the 1% annual chance flood. The floodway fringe is the area between the floodway and the 1% annual chance floodplain boundaries where encroachment is permitted. The floodway must be wide enough so that the floodway fringe could be completely obstructed without increasing the water surface elevation of the 1% annual chance flood more than 1 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 4.

To participate in the NFIP, Federal regulations require communities to limit increases caused by encroachment to 1.0 foot, provided that hazardous velocities are not produced. In Montana, the designated floodway is developed using a 0.5 foot surcharge instead of the Federal maximum of 1.0 foot. These criteria take precedence over the minimum Federal criteria for purposes of regulating development in the floodplain, as set forth in the Code of Federal Regulations, 24 CFR, 1910 (d). The floodways computed for this study are based on a maximum increase of 0.5 foot. The floodways in this project are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway projects.

Figure 4: Floodway Schematic



Floodway widths presented in this FIS Report and on the FIRM were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. The results of the floodway computations have been tabulated for selected cross sections and are shown in Table 24, "Floodway Data."

All floodways that were developed for this Flood Risk Project are shown on the FIRM using the symbology described in Figure 3. In cases where the floodway and l% annual chance floodplain boundaries are either close together or collinear, only the floodway boundary has been shown on the FIRM. For information about the delineation of floodways on the FIRM, refer to Section 6.3.

2.3 Base Flood Elevations

The hydraulic characteristics of flooding sources were analyzed to provide estimates of the elevations of floods of the selected recurrence intervals. The Base Flood Elevation (BFE) is the elevation of the 1% annual chance flood. These BFEs are most commonly rounded to the whole foot, as shown on the FIRM, but in certain circumstances or locations they may be rounded to 0.1 foot. Cross section lines shown on the FIRM may also be labeled with the BFE rounded to 0.1 foot. Whole-foot BFEs derived from engineering analyses that apply to coastal areas, areas of ponding, or other static areas with little elevation change may also be shown at selected intervals on the FIRM.

Cross sections with BFEs shown on the FIRM correspond to the cross sections shown in the Floodway Data table and Flood Profiles in this FIS Report. BFEs are primarily intended for flood insurance rating purposes. For construction and/or floodplain management purposes, users are

cautioned to use the flood elevation data presented in this FIS Report in conjunction with the data shown on the FIRM.

2.4 Non-Encroachment Zones

This section is not applicable to this Flood Risk Project.

2.5 Coastal Flood Hazard Areas

This section is not applicable to this Flood Risk Project.

2.5.1 Water Elevations and the Effects of Waves

This section is not applicable to this Flood Risk Project.

Figure 5: Wave Runup Transect Schematic

[Not Applicable to this Flood Risk Project]

2.5.2 Floodplain Boundaries and BFEs for Coastal Areas

This section is not applicable to this Flood Risk Project.

2.5.3 Coastal High Hazard Areas

This section is not applicable to this Flood Risk Project.

Figure 6: Coastal Transect Schematic

[Not Applicable to this Flood Risk Project]

2.5.4 Limit of Moderate Wave Action

This section is not applicable to this Flood Risk Project.

SECTION 3.0 – INSURANCE APPLICATIONS

3.1 National Flood Insurance Program Insurance Zones

For flood insurance applications, the FIRM designates flood insurance rate zones as described in Figure 3, "Map Legend for FIRM." Flood insurance zone designations are assigned to flooding sources based on the results of the hydraulic or coastal analyses. Insurance agents use the zones shown on the FIRM and depths and base flood elevations in this FIS Report in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

The 1% annual chance floodplain boundary corresponds to the boundary of the areas of special flood hazards (e.g. Zones A, AE, V, VE, etc.), and the 0.2% annual chance floodplain boundary corresponds to the boundary of areas of additional flood hazards.

Table 3 lists the flood insurance zones in Wheatland County.

Table 3: Flood Zone Designations by Community

Community	Flood Zone(s)
Harlowton, City of	AE, X
Judith Gap, Town of*	D, X
Wheatland County Unincorporated Areas	A, AE, AO, D, X

* No Special Flood Hazard Areas Identified

3.2 Coastal Barrier Resources System

This section is not applicable to this Flood Risk Project.

Table 4: Coastal Barrier Resources System Information

[Not Applicable to this Flood Risk Project]

SECTION 4.0 – AREA STUDIED

4.1 Basin Description

Table 5 contains a description of the characteristics of the HUC-8 sub-basins within which each community falls. The table includes the main flooding sources within each basin, a brief description of the basin, and its drainage area.

Table 5: Basin Characteristics

HUC-8 Sub-Basin Name	HUC-8 Sub-Basin Number	Primary Flooding Source	Description of Affected Area	Drainage Area (square miles)
Judith	10040103	Musselshell River	Affecting a very small portion of southeastern Wheatland County near the boundaries Judith Basin and Fergus counties	2,762
Upper Musselshell	10040201	Musselshell River	Originates at the confluence of the North Fork and South Fork of the Musselshell River near the town of Martinsdale, Montana to the confluence with the Missouri River and Fort Peck Reservoir	4,011

4.2 Principal Flood Problems

Table 6 contains a description of the principal flood problems that have been noted for Wheatland County by flooding source.

Table 6: Principal Flood Problems

Flooding Source	Description of Flood Problems
Antelope Creek	Most flooding from Antelope Creek in the vicinity of Harlowton is caused by both snowmelt and direct rainfall. An extremely rare event on June 17,1960 is the flood of record. Using indirect methods, USGS published the peak discharge at 24,400 cfs. This flood was recorded at USGS gage 06120900, however; most floodwater was from a tributary of Antelope Creek, now gaged by 06120800. Local residents who observed the cloudburst reported that it centered on the drainage area of gage 06120800 and that 8 to 10 inches of rain fell at some locations. This Antelope Creek flood had a runoff of approximately 1,100 cfs per square mile. It is one of the most extreme floods ever witnessed in Montana. In addition, this flood ranks among the largest ever observed in terms of runoff per square mile when compared with other maximum known floods as presented in the U.S. Geological Survey Open-File Report 75-650 (USGS 1976). This flood resulted in loss of life and considerable property damage along Antelope Creek. Other significant floods recorded on Antelope Creek were 1,600 cfs in 1954 and 1,280 cfs in 1962.
Antelope Overflow (Jawbone Creek)	A storm on July 12, 1962, caused flooding in Harlowton from Antelope Overflow. This flood had a discharge of 749 cfs and was approximately equal to a 2-percent-annual-chance flood event.
Harlowton Overflow Channel	Flooding originates from two sources, direct rainfall and snowmelt runoff from a local 3-square-mile watershed about US Highway 191 embankment; and overflow of Musselshell River at the Chicago, Milwaukee, St. Paul and Pacific Railroad bridge 2 miles upstream from the City of Harlowton. This is the principal flooding source in the City of Harlowton. During flooding conditions, the channel flows easterly along the northern side of the Chicago, Milwaukee, St. Paul & Pacific Railroad. Floodwaters from Harlowton Overflow Channel join Jawbone Creek, pass through a bridge on the Lewistown Branch of the Chicago, Milwaukee, St. Paul & Pacific Railroad, and empty into Antelope Creek, east of Harlowton. Direct rainfall and snowmelt runoff from the local 3-square-mile watershed above the U.S. Highway 191 embankment contributes to flooding along Harlowton Overflow Channel and Jawbone Creek. This watershed produced a flood of 200 cfs in June 1979 (approximately a 10-percent-annual-chance event). Floodwaters from Musselshell River also contribute to flooding along Harlowton Overflow Channel. Some of the flooding from Musselshell River overflows the channel banks north of the railroad bridge west of Harlowton and flows easterly until it combines with Harlowton Overflow Channel west of U.S. Highway 191. Floods from the overflow of Musselshell River have occurred in June 1975 and 1967. The 1975 flood was approximately a 0.4-percent-annual-chance event and transferred 600 cfs to Harlowton Overflow Channel. These floods have caused substantial damage to St. Josephs Park and commercial and residential properties in the southern one-third of Harlowton.

Table 6: Principal Flood Problems - continued

Flooding Source	Description of Flood Problems
Musselshell River	Most flooding is caused by both snowmelt and direct rainfall. Musselshell River has caused most of the flooding problems in Wheatland County. Major floods have occurred in May 1917, with a peak of 4,020 cfs, 3.3-percent-annual-chance flood event: in June 1938, with a peak of 4,530 cfs, a 2.5-percent-annual-chance flood event: in June 1967, with a peak of 2,880 cfs, a 10-percent-annual-chance flood event: and in June 1975 with a peak of 7,270 cfs, a 0.4-percent-annual-chance flood event. More recently, a peak discharge of 5,520 cfs was recorded on May 25, 2011 at USGS gage 06120500 near Harlowton, Montana. These floods have covered many acres of the broad Musselshell River valley and inundated many homes and businesses.

Table 7 contains information about historic flood elevations in the communities within Wheatland County.

Table 7: Historic Flooding Elevations

[Not Applicable to this Flood Risk Project]

4.3 Non-Levee Flood Protection Measures

This section is not applicable to this Flood Risk Project.

Table 8: Non-Levee Flood Protection Measures

[Not Applicable to this Flood Risk Project]

4.4 Levees

This section is not applicable to this Flood Risk Project.

Table 9: Levees

[Not Applicable to this Flood Risk Project]

SECTION 5.0 – ENGINEERING METHODS

For the flooding sources in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude that are expected to be equaled or exceeded at least once on the average during any 10-, 25-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 25-, 50-, 100-, and 500-year floods, have a 10-, 4-, 2-, 1-, and 0.2% annual chance, respectively, of being equaled or exceeded during any year.

Although the recurrence interval represents the long-term, average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood that equals or exceeds the 100-year flood (1-percent chance of annual exceedance) during the term of a 30-year mortgage is approximately 26 percent (about 3 in 10); for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

5.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak elevation-frequency relationships for floods of the selected recurrence intervals for each flooding source studied. Hydrologic analyses are typically performed at the watershed level. Depending on factors such as watershed size and shape, land use and urbanization, and natural or man-made storage, various models or methodologies may be applied. A summary of the hydrologic methods applied to develop the discharges used in the hydraulic analyses for each stream is provided in Table 13. Greater detail (including assumptions, analysis, and results) is available in the archived project documentation.

A summary of the discharges is provided in Table 10. Stream gage information is provided in Table 12.

Table 10: Summary of Discharges

Flooding Source	Location	Drainage Area (Square Miles)	Peak Discharge (cfs)				
			10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Antelope Creek	Downstream Study Limit, Confluence with Musselshell River	91.2	1,520	4,920	10,640	21,490	91,550
Antelope Creek	Upstream of Alkali Creek Confluence	71.6	1,290	4,230	9,230	18,800	81,310
Musselshell River	USGS Station 06123030	1,515	3,495	5,673	7,665	9,968	16,580
Musselshell River	River Mile 262	1,495	3,449	5,568	7,500	9,729	16,110
Musselshell River	River Mile 268.7	1,453	3,356	5,360	7,174	9,258	15,190
Musselshell River	American Fork	1,231	2,863	4,290	5,533	6,925	10,770
Musselshell River	USGS Station 06120500	1,118	2,610	3,768	4,756	5,848	8,816
Musselshell River	Milton Creek	1,094	2,595	3,742	4,722	5,804	8,747
Musselshell River	Mud Creek	981	2,522	3,617	4,552	5,586	8,407

Figure 7: Frequency Discharge-Drainage Area Curves

[Not Applicable to this Flood Risk Project]

Table 11: Summary of Non-Coastal Stillwater Elevations

[Not Applicable to this Flood Risk Project]

Table 12: Stream Gage Information used to Determine Discharges

Flooding Source	Gage Identifier	Agency that Maintains Gage	Site Name	Drainage Area (Square Miles)	Period of Record	
					From	To
Antelope Creek	06120900	USGS	Antelope Creek at Harlowton, Montana	91	1950	1980
Musselshell River	06120500	USGS	Musselshell River at Harlowton MT	1,125	1909	2014
Musselshell River	06123030	USGS	Musselshell River above Mud Creek, near Shawmut	1,518	1998	2015

5.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals. Base flood elevations on the FIRM represent the elevations shown on the Flood Profiles and in the Floodway Data tables in the FIS Report. Rounded whole-foot elevations may be shown on the FIRM in coastal areas, areas of ponding, and other areas with static base flood elevations. These whole-foot elevations may not exactly reflect the elevations derived from the hydraulic analyses. Flood elevations shown on the FIRM are primarily intended for flood insurance rating purposes. For construction and/or floodplain management purposes, users are cautioned to use the flood elevation data presented in this FIS Report in conjunction with the data shown on the FIRM. The hydraulic analyses for this FIS were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

For streams for which hydraulic analyses were based on cross sections, locations of selected cross sections are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 6.3), selected cross sections are also listed in Table 24, "Floodway Data."

A summary of the methods used in hydraulic analyses performed for this project is provided in Table 13. Roughness coefficients are provided in Table 14. Roughness coefficients are values representing the frictional resistance water experiences when passing overland or through a channel. They are used in the calculations to determine water surface elevations. Greater detail (including assumptions, analysis, and results) is available in the archived project documentation.

Table 13: Summary of Hydrologic and Hydraulic Analyses

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Antelope Creek	Confluence with the Musselshell River near Harlowton, MT	Approximately stream mile 4.2	Expected Moments Algorithm	HEC-RAS, 4.1.0	06/15/2016	AE, AE with Floodway	Limited detail study without floodway Detailed study with floodway[1]
Antelope Overflow	Confluence with Antelope Creek near Harlowton, MT	Point of diversion from Antelope Creek near Harlowton, MT	Expected Moments Algorithm	HEC-RAS, 4.1.0	06/15/2016	AE with Floodway	Limited detail study without floodway Detailed study with floodway[1]
Harlowton Overflow Channel	Confluence with the Musselshell River near Harlowton, MT	Point of diversion from the Musselshell River west of Harlowton, MT	Two site logarithmic interpolation methods with USGS WRIR 03-4308	HEC-RAS, 4.1.0	06/15/2016	AE	Limited detail study without floodway Detailed study with floodway[1]
Musselshell River	Wheatland County, MT eastern county line	River mile 45	Two site logarithmic interpolation methods with USGS WRIR 03-4308	HEC-RAS, 4.1.0	06/15/2016	AE, AE with Floodway	Limited detail study without floodway Detailed study with floodway[1]
Railroad Split	Red Bridge Road near Harlowton, MT	Point of diversion from Antelope Creek near Harlowton, MT	Two site logarithmic interpolation methods with USGS WRIR 03-4308	HEC-RAS, 4.1.0	06/15/2016	AE with Floodway	Limited detail study without floodway Detailed study with floodway[1]

[1] Floodways computed for the detailed study reaches in the Town of Harlowton (Reaches 9 & 10)

Table 14: Roughness Coefficients

Flooding Source	Channel “n”	Overbank “n”
Antelope Creek	0.035-0.065	0.058-0.130
Antelope Overflow	0.044-0.075	0.060-0.100
Harlowton Overflow Channel	0.039-0.075	0.058-0.078
Musselshell River	0.035-0.090	0.058-0.200
Railroad Split	0.050-0.065	0.051-0.070

5.3 Coastal Analyses

This section is not applicable to this Flood Risk Project.

Table 15: Summary of Coastal Analyses
[Not Applicable to this Flood Risk Project]

5.3.1 Total Stillwater Elevations

This section is not applicable to this Flood Risk Project.

Figure 8: 1% Annual Chance Total Stillwater Elevations for Coastal Areas
[Not Applicable to this Flood Risk Project]

Table 16: Tide Gage Analysis Specifics
[Not Applicable to this Flood Risk Project]

5.3.2 Waves

This section is not applicable to this Flood Risk Project.

5.3.3 Coastal Erosion

This section is not applicable to this Flood Risk Project.

5.3.4 Wave Hazard Analyses

This section is not applicable to this Flood Risk Project.

Table 17: Coastal Transect Parameters
[Not Applicable to this Flood Risk Project]

Figure 9: Transect Location Map
[Not Applicable to this Flood Risk Project]

5.4 Alluvial Fan Analyses

This section is not applicable to this Flood Risk Project.

Table 18: Summary of Alluvial Fan Analyses
[Not Applicable to this Flood Risk Project]

Table 19: Results of Alluvial Fan Analyses
[Not Applicable to this Flood Risk Project]

SECTION 6.0 – MAPPING METHODS

6.1 Vertical and Horizontal Control

All FIS Reports and FIRMs are referenced to a specific vertical datum. The vertical datum provides a starting point against which flood, ground, and structure elevations can be referenced and compared. Until recently, the standard vertical datum used for newly created or revised FIS Reports and FIRMs was the National Geodetic Vertical Datum of 1929 (NGVD29). With the completion of the North American Vertical Datum of 1988 (NAVD88), many FIS Reports and FIRMs are now prepared using NAVD88 as the referenced vertical datum.

Flood elevations shown in this FIS Report and on the FIRMs are referenced to NAVD88. These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. For information regarding conversion between NGVD29 and NAVD88 or other datum conversion, visit the National Geodetic Survey website at www.ngs.noaa.gov.

Temporary vertical monuments are often established during the preparation of a flood hazard analysis for the purpose of establishing local vertical control. Although these monuments are not shown on the FIRM, they may be found in the archived project documentation associated with the FIS Report and the FIRMs for this community. Interested individuals may contact FEMA to access these data.

To obtain current elevation, description, and/or location information for benchmarks in the area, please visit the NGS website at www.ngs.noaa.gov.

The datum conversion locations and values that were calculated for Wheatland County are provided in Table 20.

Table 20: Countywide Vertical Datum Conversion

[Not Applicable to this Flood Risk Project]

Table 21: Stream-Based Vertical Datum Conversion

[Not Applicable to this Flood Risk Project]

6.2 Base Map

The FIRMs and FIS Report for this project have been produced in a digital format. The flood hazard information was converted to a Geographic Information System (GIS) format that meets FEMA's FIRM Database specifications and geographic information standards. This information is provided in a digital format so that it can be incorporated into a local GIS and be accessed more easily by the community. The FIRM Database includes most of the tabular information contained in the FIS Report in such a way that the data can be associated with pertinent spatial features. For example, the information contained in the Floodway Data table and Flood Profiles can be linked to the cross sections that are shown on the FIRMs. Additional information about the FIRM Database and its contents can be found in FEMA's *Guidelines and Standards for Flood Risk*

Analysis and Mapping, www.fema.gov/guidelines-and-standards-flood-risk-analysis-and-mapping.

Base map information shown on the FIRM was derived from the sources described in Table 22.

Table 22: Base Map Sources

Data Type	Data Provider	Data Date	Data Scale	Data Description
USDA-FSA-APFO NAIP MrSID Mosaic	USDA/FSA - Aerial Photography Field Office	10/1/2013	1:12,000	Color orthoimagery was provided for the county
Montana Corporate Boundaries	Montana State Library	09/24/2015	N/A	Politcal boundaries
FIRM Panel Boundary	Michael Baker International	12/14/2015	1:24,000	FIRM Panels
Montana Transportation Framework	Montana State Library	08/19/2014	N/A	Transportation lines
PLSS Framework	Montana State Library	07/07/2015	N/A	PLSS data were digitized from USGS quadrangles
Montana Hydrography Framework	Montana State Library	03/19/2015	N/A	Water Lines and Polygons
Structure Inventory	Musselshell Watershed Coalition	12/14/2015	N/A	General Structures

6.3 Floodplain and Floodway Delineation

The FIRM shows tints, screens, and symbols to indicate floodplains and floodways as well as the locations of selected cross sections used in the hydraulic analyses and floodway computations.

For riverine flooding sources, the mapped floodplain boundaries shown on the FIRM have been delineated using the flood elevations determined at each cross section; between cross sections, the boundaries were interpolated using the topographic elevation data described in Table 23.

In cases where the 1% and 0.2% annual chance floodplain boundaries are close together, only the 1% annual chance floodplain boundary has been shown. Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

The floodway widths presented in this FIS Report and on the FIRM were computed for certain stream segments on the basis of equal conveyance reduction from each side of the floodplain. Floodway widths were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. Table 2 indicates the flooding sources for which floodways have been determined. The results of the floodway computations for those flooding sources have been tabulated for selected cross sections and are shown in Table 24, “Floodway Data.”

Table 23: Summary of Topographic Elevation Data used in Mapping

Community	Flooding Source	Source for Topographic Elevation Data			
		Description	Vertical Accuracy	Horizontal Accuracy	Citation
Wheatland County	Musselshell River & Antelope Creek	LiDAR	1 m GSD	1 meter	Quantum Spatial, 2016
Wheatland County	Musselshell River	LiDAR	1 meter GSD	3 foot	NRCS/USACE 2012

BFEs shown at cross sections on the FIRM represent the 1% annual chance water surface elevations shown on the Flood Profiles and in the Floodway Data tables in the FIS Report.

In Montana, the designated floodway is developed using a 0.5 foot surcharge instead of the Federal maximum of 1.0 foot (MDNCR 2014). These criteria take precedence over the minimum Federal criteria for purposes of regulating development in the floodplain, as set forth in the Code of Federal Regulations, 24 CFR, 1910 (d). The floodways computed for this study are based on a maximum increase of 0.5 foot.

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Table 24: Floodway Data

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/ SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
ANTELOPE CREEK								
A	0	625	1,486	5.2	4,149.1	4,149.1	4,149.5	0.4
B	1,361	1,541[2]	6,022	3.6	4,157.7	4,157.7	4,158.2	0.5
C	3,132	562	3,854	5.3	4,177.9	4,177.9	4,178.3	0.4
D	4,501	347	2,432	8.5	4,181.7	4,181.7	4,182.2	0.5

[1] Feet upstream of the Confluence with the Musselshell River
[2] Floodway topwidth includes width of high ground area

TABLE 24

FEDERAL EMERGENCY MANAGEMENT AGENCY

WHEATLAND COUNTY, MT

AND INCORPORATED AREAS

FLOODWAY DATA

FLOODING SOURCE: ANTELOPE CREEK

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/ SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
ANTELOPE OVERFLOW								
A	553	1,018[2]	3,951	1.7	4,159.2	4,159.2	4,159.6	0.4
B	2,144	180	402	2.9	4,161.6	4,161.6	4,162.1	0.5
C	4,074	53	176	4.1	4,183.4	4,183.4	4,183.6	0.2

[1] Feet upstream of the Confluence with Antelope Creek
[2] Floodway topwidth includes width of high ground area

TABLE 24

FEDERAL EMERGENCY MANAGEMENT AGENCY

WHEATLAND COUNTY, MT

AND INCORPORATED AREAS

FLOODWAY DATA

FLOODING SOURCE: ANTELOPE OVERFLOW

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/ SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
MUSSSELSHELL RIVER								
BQ	195,296	1,321[2]	2,000	2.9	4,128.8	4,128.8	4,129.0	0.2
BR	195,945	567[2]	1,196	4.9	4,130.6	4,130.6	4,131.1	0.5
BS	197,464	207	1,128	5.2	4,138.2	4,138.2	4,138.2	0.0
BT	199,201	198	915	6.4	4,140.9	4,140.9	4,141.1	0.2
BU	200,520	175	950	6.2	4,145.3	4,145.3	4,145.6	0.3
BV	201,577	450	1,875	3.1	4,147.6	4,147.6	4,148.0	0.4
BW	203,019	420	1,397	4.2	4,150.9	4,150.9	4,151.3	0.4
BX	205,924	1,513[2]	3,165	1.9	4,155.2	4,155.2	4,155.7	0.5
BY	207,579	777	1,715	3.4	4,159.5	4,159.5	4,160.0	0.5
BZ	209,174	911	2,019	2.9	4,164.5	4,164.5	4,164.7	0.2
CA	211,011	944	2,587	2.2	4,168.8	4,168.8	4,169.1	0.3
CB	212,036	826[2]	1,583	3.5	4,172.1	4,172.1	4,172.6	0.5
CC	213,701	293	1,008	5.5	4,178.8	4,178.8	4,178.8	0.0
CD	215,293	898	1,352	4.1	4,182.4	4,182.4	4,182.6	0.2
CE	216,374	687	2,150	2.6	4,185.5	4,185.5	4,185.9	0.4
CF	217,518	1,148[2]	1,702	3.3	4,187.9	4,187.9	4,188.2	0.3
CG	219,064	280	1,102	5.0	4,192.4	4,192.4	4,192.9	0.5
CH	220,617	381	1,313	4.2	4,195.4	4,195.4	4,195.9	0.5
CI	222,113	634	1,823	3.0	4,199.4	4,199.4	4,199.9	0.5
CJ	223,428	411	1,316	4.2	4,204.2	4,204.2	4,204.7	0.5
CK	224,628	543	1,521	3.6	4,205.4	4,205.4	4,205.8	0.4
CL	225,751	404	1,308	4.2	4,209.5	4,209.5	4,210.0	0.5

[1] Feet upstream of the eastern Wheatland County Line

[2] Floodway topwidth includes width of high ground area

TABLE 24

FEDERAL EMERGENCY MANAGEMENT AGENCY

WHEATLAND COUNTY, MT

AND INCORPORATED AREAS

FLOODWAY DATA

FLOODING SOURCE: MUSSELSHELL RIVER

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/ SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
MUSSSELSHELL RIVER								
CM	227,632	906	2,970	2.0	4,215.2	4,215.2	4,215.4	0.2
CN	229,039	245	1,010	5.5	4,220.4	4,220.4	4,220.4	0.0
CO	230,408	195	780	7.2	4,223.7	4,223.7	4,224.0	0.3
CP	231,434	378	1,243	4.5	4,226.9	4,226.9	4,227.3	0.4
CQ	232,654	220	1,076	5.2	4,230.2	4,230.2	4,230.6	0.4
CR	234,119	413	1,436	3.9	4,233.7	4,233.7	4,234.2	0.5
CS	235,738	780	3,028	1.8	4,236.5	4,236.5	4,237.0	0.5
CT	237,313	776	1,763	3.2	4,239.3	4,239.3	4,239.8	0.5
CU	238,761	1187[2]	2,276	2.5	4,242.3	4,242.3	4,242.4	0.1

[1] Feet upstream of the eastern Wheatland County Line
[2] Floodway topwidth includes width of high ground area

TABLE 24

FEDERAL EMERGENCY MANAGEMENT AGENCY

WHEATLAND COUNTY, MT

AND INCORPORATED AREAS

FLOODWAY DATA

FLOODING SOURCE: MUSSELSHELL RIVER

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/ SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
RAILROAD SPLIT								
A	0	675	687	5.8	4,137.3	4,137.3	4,137.4	0.1
B	1,982	1,033	5,844	2.1	4,146.2	4,146.2	4,146.7	0.5
C	3,506	374	1,310	10.5	4,153.6	4,153.6	4,153.8	0.2

[1] Feet upstream of Red Bridge Road

TABLE 24

FEDERAL EMERGENCY MANAGEMENT AGENCY

WHEATLAND COUNTY, MT

AND INCORPORATED AREAS

FLOODWAY DATA

FLOODING SOURCE: RAILROAD SPLIT

Table 25: Flood Hazard and Non-Encroachment Data for Selected Streams
[Not Applicable to this Flood Risk Project]

6.4 Coastal Flood Hazard Mapping

This section is not applicable to this Flood Risk Project.

Table 26: Summary of Coastal Transect Mapping Considerations
[Not Applicable to this Flood Risk Project]

6.5 FIRM Revisions

This FIS Report and the FIRM are based on the most up-to-date information available to FEMA at the time of its publication; however, flood hazard conditions change over time. Communities or private parties may request flood map revisions at any time. Certain types of requests require submission of supporting data. FEMA may also initiate a revision. Revisions may take several forms, including Letters of Map Amendment (LOMAs), Letters of Map Revision Based on Fill (LOMR-Fs), Letters of Map Revision (LOMRs) (referred to collectively as Letters of Map Change (LOMCs)), Physical Map Revisions (PMRs), and FEMA-contracted restudies. These types of revisions are further described below. Some of these types of revisions do not result in the republishing of the FIS Report. To assure that any user is aware of all revisions, it is advisable to contact the community repository of flood-hazard data (shown in Table 31, "Map Repositories").

6.5.1 Letters of Map Amendment

A LOMA is an official revision by letter to an effective NFIP map. A LOMA results from an administrative process that involves the review of scientific or technical data submitted by the owner or lessee of property who believes the property has incorrectly been included in a designated SFHA. A LOMA amends the currently effective FEMA map and establishes that a specific property is not located in a SFHA.

To obtain an application for a LOMA, visit www.fema.gov/floodplain-management/letter-map-amendment-loma and download the form "MT-1 Application Forms and Instructions for Conditional and Final Letters of Map Amendment and Letters of Map Revision Based on Fill". Visit the "Flood Map-Related Fees" section to determine the cost, if any, of applying for a LOMA.

FEMA offers a tutorial on how to apply for a LOMA. The LOMA Tutorial Series can be accessed at www.fema.gov/online-tutorials.

For more information about how to apply for a LOMA, call the FEMA Map Information eXchange; toll free, at 1-877-FEMA MAP (1-877-336-2627).

6.5.2 Letters of Map Revision Based on Fill

A LOMR-F is an official revision by letter to an effective NFIP map. A LOMR-F states FEMA's determination concerning whether a structure or parcel has been elevated on fill above the base flood elevation and is, therefore, excluded from the SFHA.

Information about obtaining an application for a LOMR-F can be obtained in the same manner as that for a LOMA, by visiting www.fema.gov/floodplain-management/letter-map-amendment-loma for the "MT-1 Application Forms and Instructions for Conditional and Final Letters of Map Amendment and Letters of Map Revision Based on Fill" or by calling the FEMA Map Information eXchange, toll free, at 1-877-FEMA MAP (1-877-336-2627). Fees for applying for a LOMR-F, if any, are listed in the "Flood Map-Related Fees" section.

A tutorial for LOMR-F is available at www.fema.gov/online-tutorials.

6.5.3 Letters of Map Revision

A LOMR is an official revision to the currently effective FEMA map. It is used to change flood zones, floodplain and floodway delineations, flood elevations and planimetric features. All requests for LOMRs should be made to FEMA through the chief executive officer of the community, since it is the community that must adopt any changes and revisions to the map. If the request for a LOMR is not submitted through the chief executive officer of the community, evidence must be submitted that the community has been notified of the request.

To obtain an application for a LOMR, visit https://www.fema.gov/media-library/assets/documents/1343 and download the form "MT-2 Application Forms and Instructions for Conditional Letters of Map Revision and Letters of Map Revision". Visit the "Flood Map-Related Fees" section to determine the cost of applying for a LOMR. For more information about how to apply for a LOMR, call the FEMA Map Information eXchange; toll free, at 1-877-FEMA MAP (1-877-336-2627) to speak to a Map Specialist.

Previously issued mappable LOMCs (including LOMRs) that have been incorporated into the Wheatland County FIRM are listed in Table 27.

Table 27: Incorporated Letters of Map Change

[Not Applicable to this Flood Risk Project]

6.5.4 Physical Map Revisions

A Physical Map Revisions (PMR) is an official republication of a community's NFIP map to effect changes to base flood elevations, floodplain boundary delineations, regulatory floodways and planimetric features. These changes typically occur as a result of structural works or improvements, annexations resulting in additional flood hazard areas or correction to base flood elevations or SFHAs.

The community's chief executive officer must submit scientific and technical data to FEMA to support the request for a PMR. The data will be analyzed and the map will be revised if warranted. The community is provided with copies of the revised information and is afforded a review period. When the base flood elevations are changed, a 90-day appeal period is provided. A 6-month adoption period for formal approval of the revised map(s) is also provided.

For more information about the PMR process, please visit www.fema.gov and visit the "Flood Map Revision Processes" section.

6.5.5 Contracted Restudies

The NFIP provides for a periodic review and restudy of flood hazards within a given community. FEMA accomplishes this through a national watershed-based mapping needs assessment strategy, known as the Coordinated Needs Management Strategy (CNMS). The CNMS is used by FEMA to assign priorities and allocate funding for new flood hazard analyses used to update the FIS Report and FIRM. The goal of CNMS is to define the validity of the engineering study data within a mapped inventory. The CNMS is used to track the assessment process, document engineering gaps and their resolution, and aid in prioritization for using flood risk as a key factor for areas identified for flood map updates. Visit www.fema.gov to learn more about the CNMS or contact the FEMA Regional Office listed in Section 8 of this FIS Report.

6.5.6 Community Map History

The current FIRM presents flooding information for the entire geographic area of Wheatland County. Previously, separate FIRMs, Flood Hazard Boundary Maps (FHBMs) and/or Flood Boundary and Floodway Maps (FBFMs) may have been prepared for the incorporated communities and the unincorporated areas in the county that had identified SFHAs. Current and historical data relating to the maps prepared for the project area are presented in Table 28, "Community Map History." A description of each of the column headings and the source of the date is also listed below.

- *Community Name* includes communities falling within the geographic area shown on the FIRM, including those that fall on the boundary line, nonparticipating communities, and communities with maps that have been rescinded. Communities with No Special Flood Hazards are indicated by a footnote. If all maps (FHBM, FBFM, and FIRM) were rescinded for a community, it is not listed in this table unless SFHAs have been identified in this community.

- *Initial Identification Date (First NFIP Map Published)* is the date of the first NFIP map that identified flood hazards in the community. If the FHBM has been converted to a FIRM, the initial FHBM date is shown. If the community has never been mapped, the upcoming effective date or "pending" (for Preliminary FIS Reports) is shown. If the community is listed in Table 28 but not identified on the map, the community is treated as if it were unmapped.

- *Initial FHBM Effective Date* is the effective date of the first FHBM. This date may be the same date as the Initial NFIP Map Date.

- *FHBM Revision Date(s)* is the date(s) that the FHBM was revised, if applicable.

- *Initial FIRM Effective Date* is the date of the first effective FIRM for the community.

- *FIRM Revision Date(s)* is the date(s) the FIRM was revised, if applicable. This is the revised date that is shown on the FIRM panel, if applicable. As countywide studies are completed or revised, each community listed should have its FIRM dates updated accordingly to reflect the date of the countywide study. Once the FIRMs exist in countywide format, as PMRs of FIRM panels within the county are completed, the FIRM

Revision Dates in the table for each community affected by the PMR are updated with the date of the PMR, even if the PMR did not revise all the panels within that community.

The initial effective date for the Wheatland County FIRMs in countywide format was [TBD].

Table 28: Community Map History

Community Name	Initial Identification Date	Initial FHBM Effective Date	FHBM Revision Date(s)	Initial FIRM Effective Date	FIRM Revision Date(s)
Harlowton, City of	9/16/1981	N/A	N/A	9/16/1981	[TBD]
Judith Gap, Town of*[1]	N/A	N/A	N/A	[TBD]	[TBD]
Wheatland County Unincorporated Areas	11/6/1979	11/6/1979	N/A	9/16/1981	[TBD]

*No Special Flood Hazard Areas Identified

[1]This community did not have a FIRM prior to the first countywide FIRM for Wheatland County

SECTION 7.0 – CONTRACTED STUDIES AND COMMUNITY COORDINATION

7.1 Contracted Studies

Table 29 provides a summary of the contracted studies, by flooding source, that are included in this FIS Report.

Table 29: Summary of Contracted Studies Included in this FIS Report

Flooding Source	FIS Report Dated	Contractor	Number	Work Completed Date	Affected Communities
Antelope Creek	[TBD]	Morrison-Maierle, Inc.	HSFE06-12-J-0001	May 2016	Wheatland County Unincorporated Areas
Antelope Overflow	[TBD]	Morrison-Maierle, Inc.	HSFE06-12-J-0001	May 2016	Wheatland County Unincorporated Areas; Harlowton, City of
Harlowton Overflow Channel	[TBD]	Morrison-Maierle, Inc.	HSFE06-12-J-0001	May 2016	Wheatland County Unincorporated Areas; Harlowton, City of
Musselshell River	[TBD]	Morrison-Maierle, Inc.	HSFE06-12-J-0001	May 2016	Wheatland County Unincorporated Areas
Railroad Split	[TBD]	Morrison-Maierle, Inc.	HSFE06-12-J-0001	May 2016	Wheatland County Unincorporated Areas

7.2 Community Meetings

The dates of the community meetings held for this Flood Risk Project and previous Flood Risk Projects are shown in Table 30. These meetings may have previously been referred to by a variety of names (Community Coordination Officer (CCO), Scoping, Discovery, etc.), but all meetings represent opportunities for FEMA, community officials, study contractors, and other invited guests to discuss the planning for and results of the project.

Table 30: Community Meetings

Community	FIS Report Dated	Date of Meeting	Meeting Type	Attended By
Harlowton, City of	[TBD]	12/01/2016	Scoping	FEMA, State Department of Natural Resources and Conservation, and the study contractor.
Wheatland County Unincorporated Areas	[TBD]	12/01/2016	Scoping	FEMA, State Department of Natural Resources and Conservation, and the study contractor.

SECTION 8.0 – ADDITIONAL INFORMATION

Information concerning the pertinent data used in the preparation of this FIS Report can be obtained by submitting an order with any required payment to the FEMA Engineering Library. For more information on this process, see www.fema.gov.

Table 31 is a list of the locations where FIRMs for Wheatland County can be viewed. Please note that the maps at these locations are for reference only and are not for distribution. Also, please note that only the maps for the community listed in the table are available at that particular repository. A user may need to visit another repository to view maps from an adjacent community.

Table 31: Map Repositories

Community	Address	City	State	Zip Code
Harlowton, City of	Harlowton City Hall 17 South Central Ave	Harlowton	MT	59036
Judith Gap, Town of*	N/A	N/A	N/A	N/A
Wheatland County Unincorporated Areas	Wheatland County Court Clerk 201 A Avenue NW	Harlowton	MT	59036
*No Special Flood Hazard Areas Identified				

The National Flood Hazard Layer (NFHL) dataset is a compilation of effective FIRM Databases and LOMCs. Together they create a GIS data layer for a State or Territory. The NFHL is updated as studies become effective and extracts are made available to the public monthly. NFHL data can be viewed or ordered from the website shown in Table 32.

Table 32 contains useful contact information regarding the FIS Report, the FIRM, and other relevant flood hazard and GIS data. In addition, information about the State NFIP Coordinator and GIS Coordinator is shown in this table. At the request of FEMA, each Governor has designated an agency of State or territorial government to coordinate that State's or territory's NFIP activities. These agencies often assist communities in developing and adopting necessary floodplain management measures. State GIS Coordinators are knowledgeable about the availability and location of State and local GIS data in their state.

Table 32: Additional Information

FEMA and the NFIP	
FEMA and FEMA Engineering Library website	www.fema.gov/national-flood-insurance-program-flood-hazard-mapping/engineering-library
NFIP website	www.fema.gov/national-flood-insurance-program
NFHL Dataset	msc.fema.gov

Table 32: Additional Information - continued

FEMA Region VIII	Denver Federal Center Building 710, Box 25267 Denver, CO 80225-0267 (303) 235-4800
Other Federal Agencies	
USGS website	www.usgs.gov
Hydraulic Engineering Center website	www.hec.usace.army.mil
State Agencies and Organizations	
State NFIP Coordinator	Traci Sears, CFM Department of Natural Resources and Conservation Montana Floodplain Management Program 1424 Ninth Avenue Helena, MT 59620-1601 Phone: (406) 444-6654 tsears@mt.gov
Montana Water Operations Bureau Chief	Steve Story, PE, CFM Department of Natural Resources and Conservation Montana Floodplain Management Program 1424 Ninth Avenue Helena, MT 59620-1601 Phone: (406) 444-6816 sestory@mt.gov
Wheatland County Floodplain Administrator	Page Dringman PO Box 1256 Big Timber, MT 59011 Phone: (406) 932-5470 sgplanning@itstriangle.com
State GIS Coordinator	Erin Fashoway Statewide GIS Coordinator Montana State Library 1515 E 6th Avenue Helena, MT 59620 Phone: (406) 444-9013 EFashoway@mt.gov

SECTION 9.0 – BIBLIOGRAPHY AND REFERENCES

Table 33 includes sources used in the preparation of and cited in this FIS Report as well as additional studies that have been conducted in the study area.

Table 33: Bibliography and References

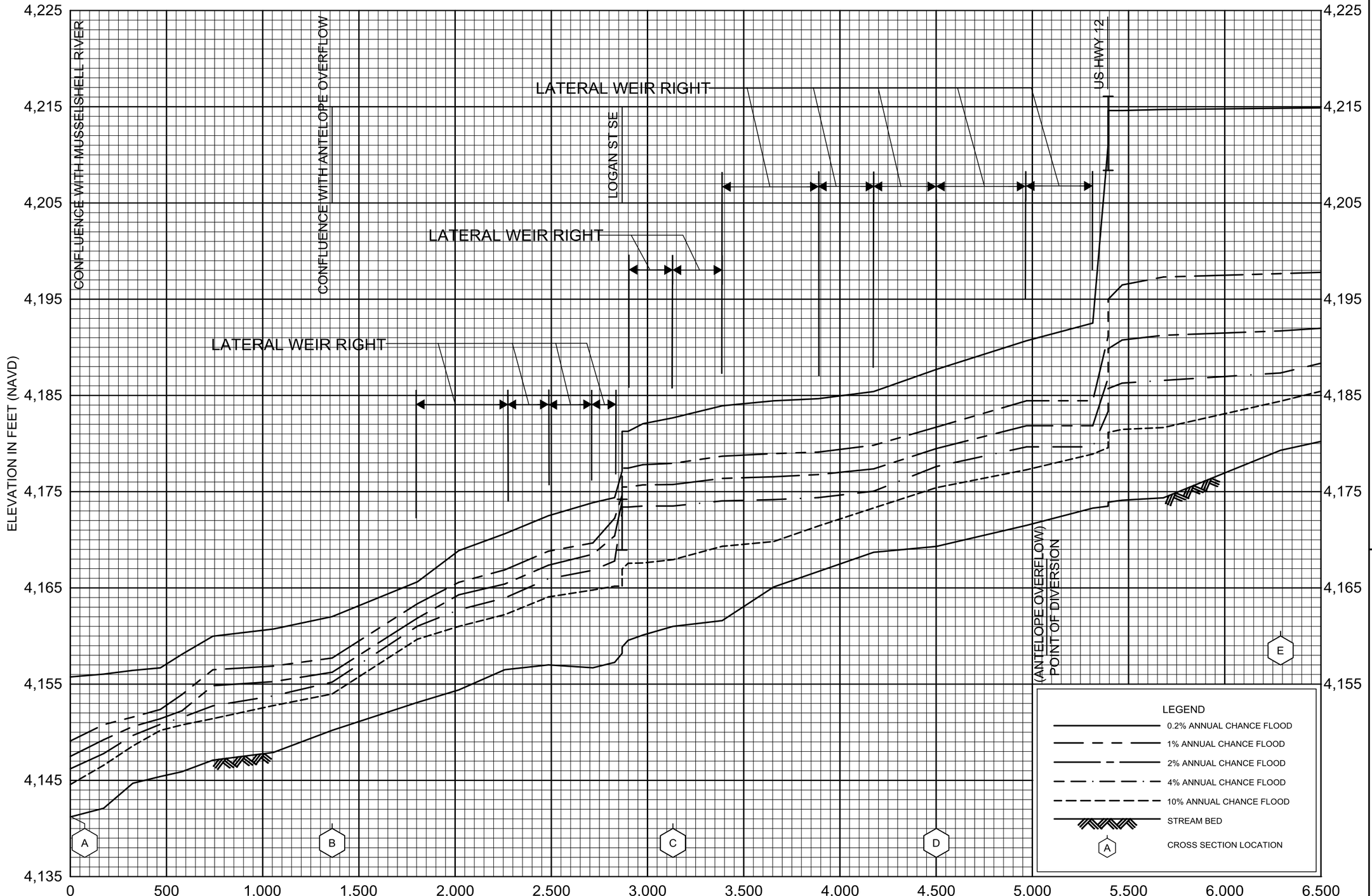
Citation in this FIS	Publisher/ Issuer	*Publication Title,* "Article," Volume, Number, etc.	Author/Editor	Place of Publication	Publication Date/ Date of Issuance	Link
Applied Geomorphology and RATT, 2012	Applied Geomorphology and RATT	*Musselshell River Flood Rehabilitation River Assessment Triage Team (RATT) Summary Report*	Applied Geomorphology and RATT	Bozeman, MT	2012	http://www.appliedgeomorph.com/
CivilGEO, 2016	CivilGEO Engineering Software	*GeoHECRAS*	CivilGEO	N/A	2016	http://www.civilgeo.com/
DNRC, 2014	Montana Department of Natural Resources and Conservation	*2014 Model Regulations*	DNRC	Helena, MT	2014	http://dnrc.mt.gov/divisions/water/operations/floodplain-management
Esri, 2012	Esri	ArcGIS Desktop: Release 10.1.	N/A	Redlands, CA	2012	http://www.esri.com/
FEMA, 2003	Federal Emergency Management Agency	*Guidelines and Specifications for Hazard Mapping Partners, Appendix J.2.2:*	N/A	N/A	2003	http://www.fema.gov/media-library-data/31d736ea5b9afbfd28a256538c4727ea/Appendix+J
FEMA, 2009	Federal Emergency Management Agency	*Guidelines and Specifications for Hazard Mapping Partners, Appendix C:*	N/A	N/A	2009	http://www.fema.gov/media-library/assets/documents/13948
FEMA, 2011	Federal Emergency Management Agency	cHECk-RAS, Version 2.0.1	N/A	N/A	2011	http://www.floodmaps.fema.gov/fhm/checkras/check-ras.asp

Table 33: Bibliography and References - continued

Citation in this FIS	Publisher/ Issuer	*Publication Title,* "Article," Volume, Number, etc.	Author/Editor	Place of Publication	Publication Date/ Date of Issuance	Link
FEMA, 2013	Federal Emergency Management Agency	RASPLOT, Version 3.0 beta	FEMA	N/A	2013	https://www.fema.gov/raplot-version-30
FEMA, 2015	Federal Emergency Management Agency	*Montana DNRC Cooperating Technical Partners Mapping Activity Statement (MAS): No. 2015-02, for Musselshell Watershed Project, Phase II*	FEMA	N/A	2015	http://www.fema.gov/media-library/assets/documents/34953
MMI, 2016	Morrison-Maierle, Inc.	*Survey Report, Musselshell River*	MMI	Helena, MT	2016	http://m-m.net/
NRCS, 2012	Natural Resources and Conservation Service	*Light Detection and Ranging (LiDAR) Survey*	NRCS	Bozeman, MT	2012	http://www.nrcs.usda.gov/wps/portal/nrcs/site/mt/home/
Parrett and Johnson, 2004	United States Geologic Survey	*Methods for estimating flood frequency in Montana based on data through water year 1998.*	USGS	Reston,VA	2004	http://wy-mt.water.usgs.gov/flood_freq/index.htm
Pioneer, 2015	Pioneer Technical Services, Inc.	*Musselshell River Floodplain Study -Phase 1, Final Field Reconnaissance and Hydraulic Structure Assessment Report.*	Pioneer Technical Services, Inc.	Bozeman, MT	2015	http://pioneer-technical.com/
Pioneer, 2015	Pioneer Technical Services, Inc.	*Musselshell River Floodplain Study -Phase 1, Musselshell River Hydrologic Analysis Report.*	Pioneer Technical Services, Inc.	Bozeman, MT	2015	http://pioneer-technical.com/

Table 33: Bibliography and References - continued

Citation in this FIS	Publisher/ Issuer	*Publication Title,* "Article," Volume, Number, etc.	Author/Editor	Place of Publication	Publication Date/ Date of Issuance	Link
USACE, 2010	United States Army Corps of Engineers	HEC-RAS 4.1.0, Hydraulic Modeling Software.	USACE Hydrologic Engineering Center	Davis,CA	2010	http://www.hec.usace.army.mil/software/hec-ras/
USACE, 2010	United States Army Corps of Engineers	*HEC-RAS Hydraulic Reference Manual, Version 4.1.0.*	USACE Hydrologic Engineering Center	Davis, CA	2010	http://www.hec.usace.army.mil/software/hec-ras/
USACE, 2010	United States Army Corps of Engineers	*HEC-RAS User's Manual, Version 4.1.0.*	USACE Hydrologic Engineering Center	Davis, CA	2010	http://www.hec.usace.army.mil/software/hec-ras/
USDA, 2012, 2014	United States Department of Agriculture	*National Agricultural Imagery Program (NIAP) aerial photographs.*	USDA	Washington, DC	2012, 2014	http://www.fsa.usda.gov/programs-and-services/aerial-photography/index
USGS, 1982	United States Geologic Survey	*Guide for Selecting Manning's Roughness Coefficients for Natural Channels and Flood Plains, Water-supply Paper 2339.*	USGS	Reston, VA	1982	http://pubs.er.usgs.gov/browse/usgs-publications
USGS, 1982	United States Geologic Survey	Interagency Advisory Committee on Water Data, *Guidelines for Determining Flood Flow Frequency, Bulletin #17B of the Hydrology Subcommittee.*	USGS	Reston, VA	1982	http://pubs.er.usgs.gov/browse/usgs-publications



FLOOD PROFILES

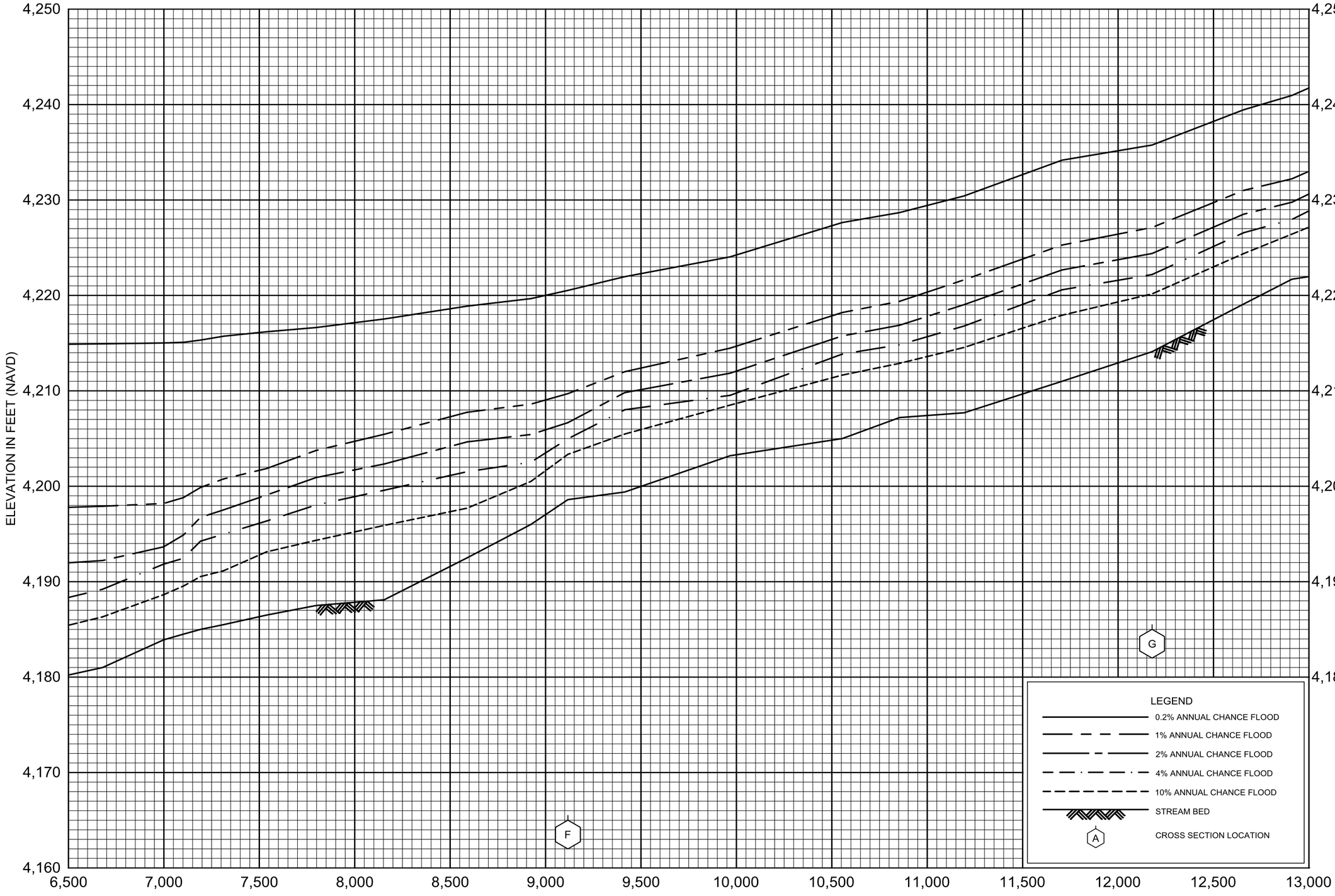
ANTELOPE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

WHEATLAND COUNTY, MT

AND INCORPORATED AREAS

01P



FLOOD PROFILES

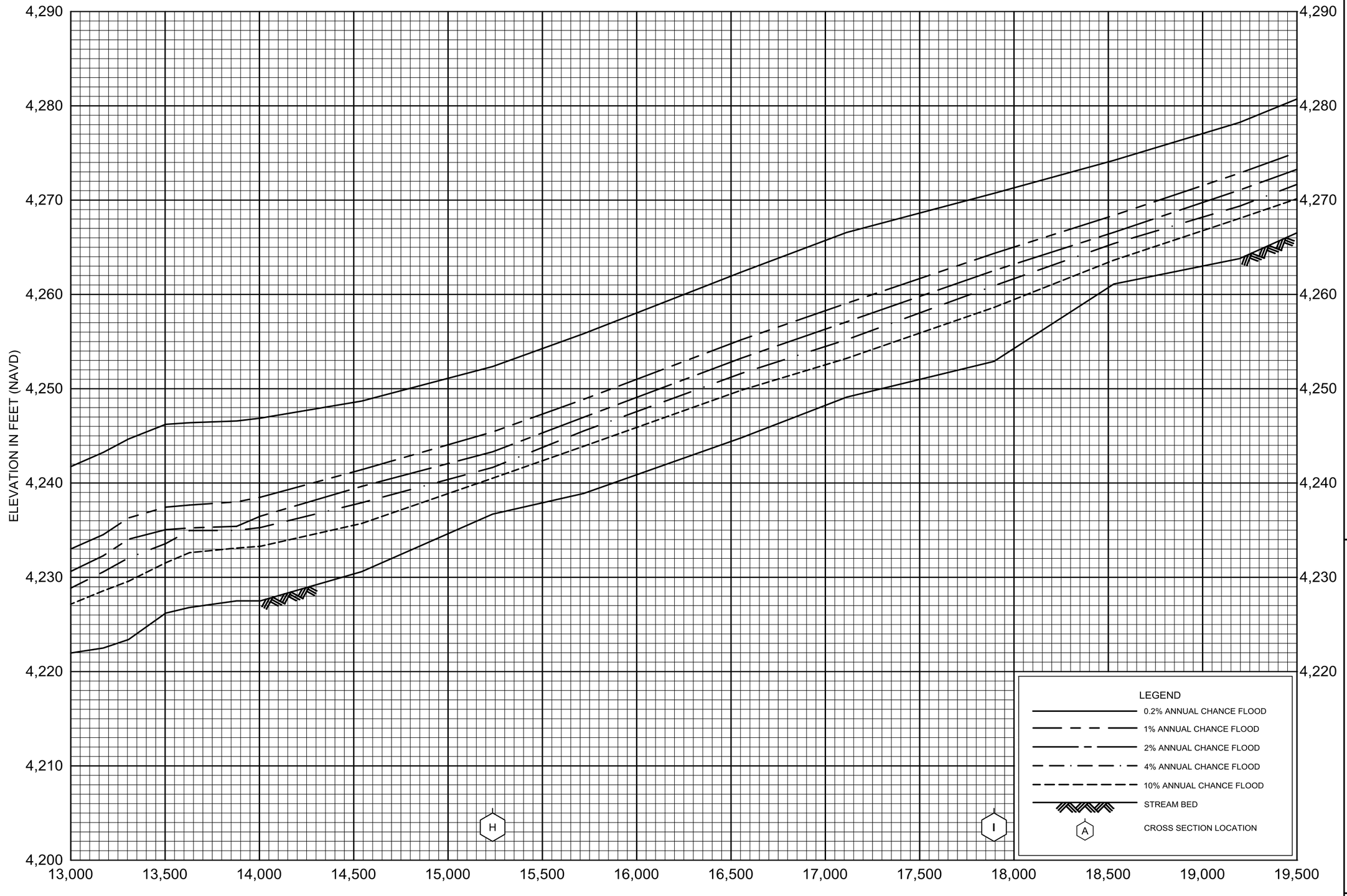
ANTELOPE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

WHEATLAND COUNTY, MT

AND INCORPORATED AREAS

02P



FLOOD PROFILES

ANTELOPE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

WHEATLAND COUNTY, MT

AND INCORPORATED AREAS

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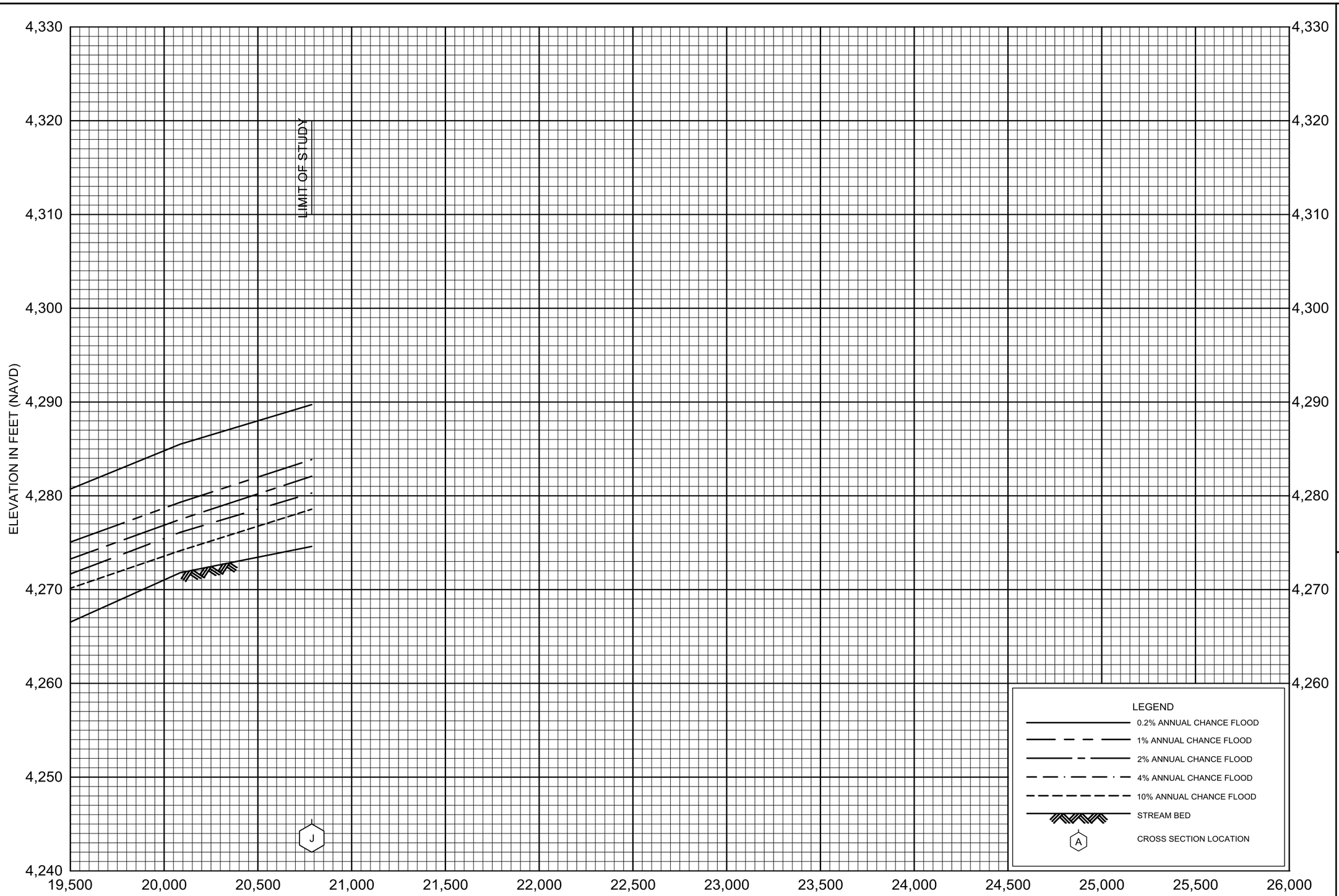


FLOOD PROFILES

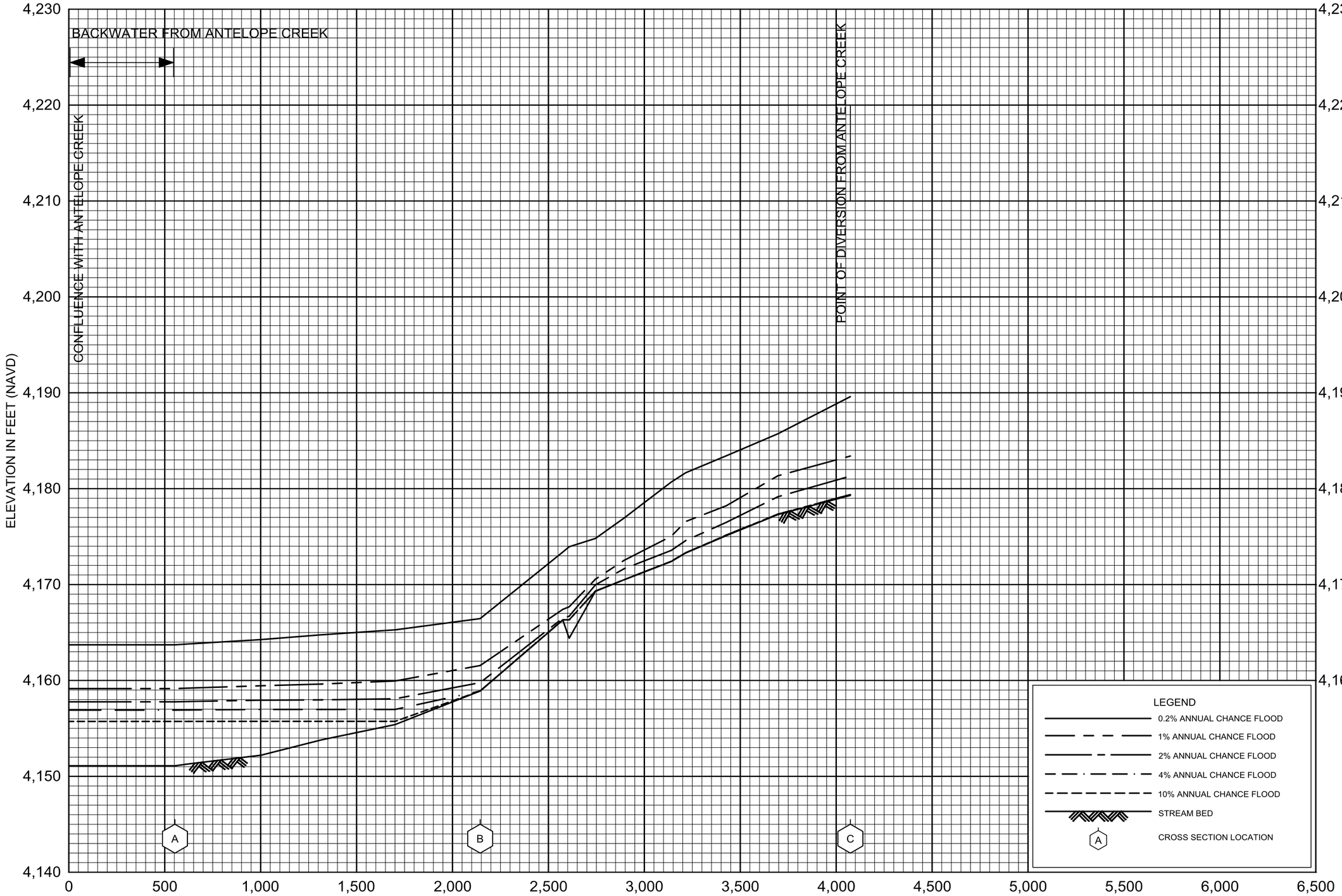
ANTELOPE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

WHEATLAND COUNTY, MT

AND INCORPORATED AREAS

04P



FLOOD PROFILES

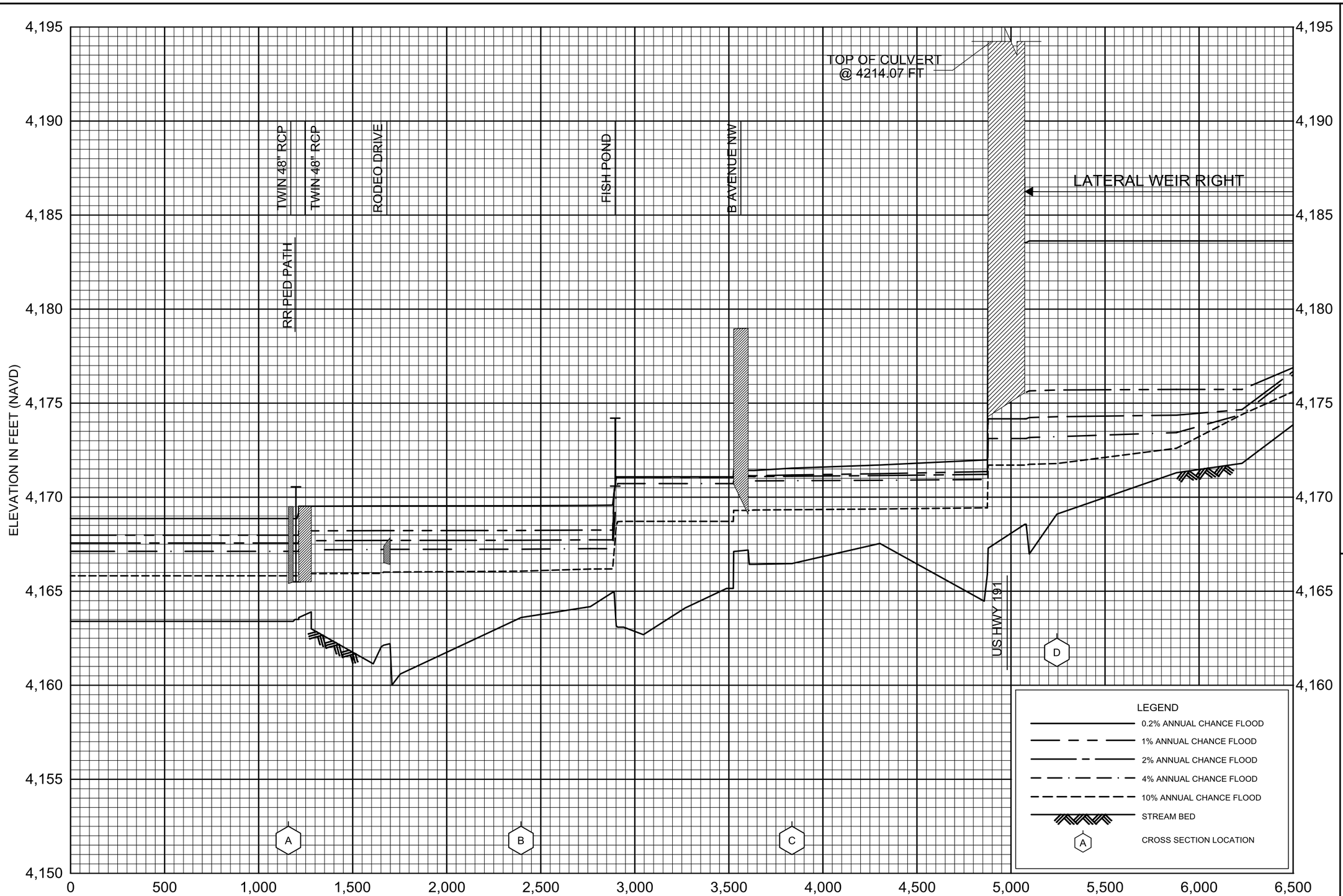
ANTELOPE OVERFLOW

FEDERAL EMERGENCY MANAGEMENT AGENCY

WHEATLAND COUNTY, MT

AND INCORPORATED AREAS

05P



FLOOD PROFILES

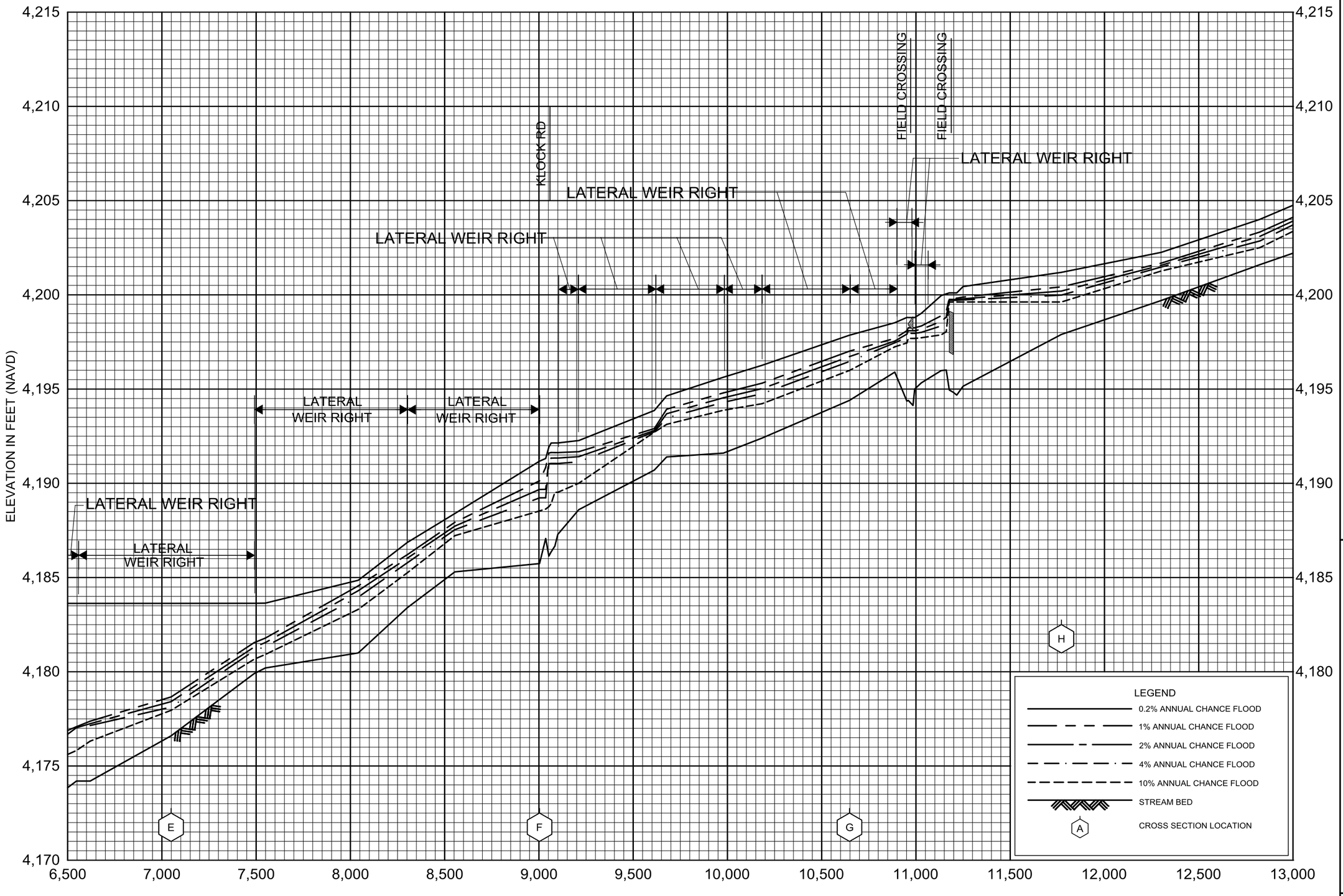
HARLOWTON OVERFLOW CHANNEL

FEDERAL EMERGENCY MANAGEMENT AGENCY

WHEATLAND COUNTY, MT

AND INCORPORATED AREAS

06P



FLOOD PROFILES

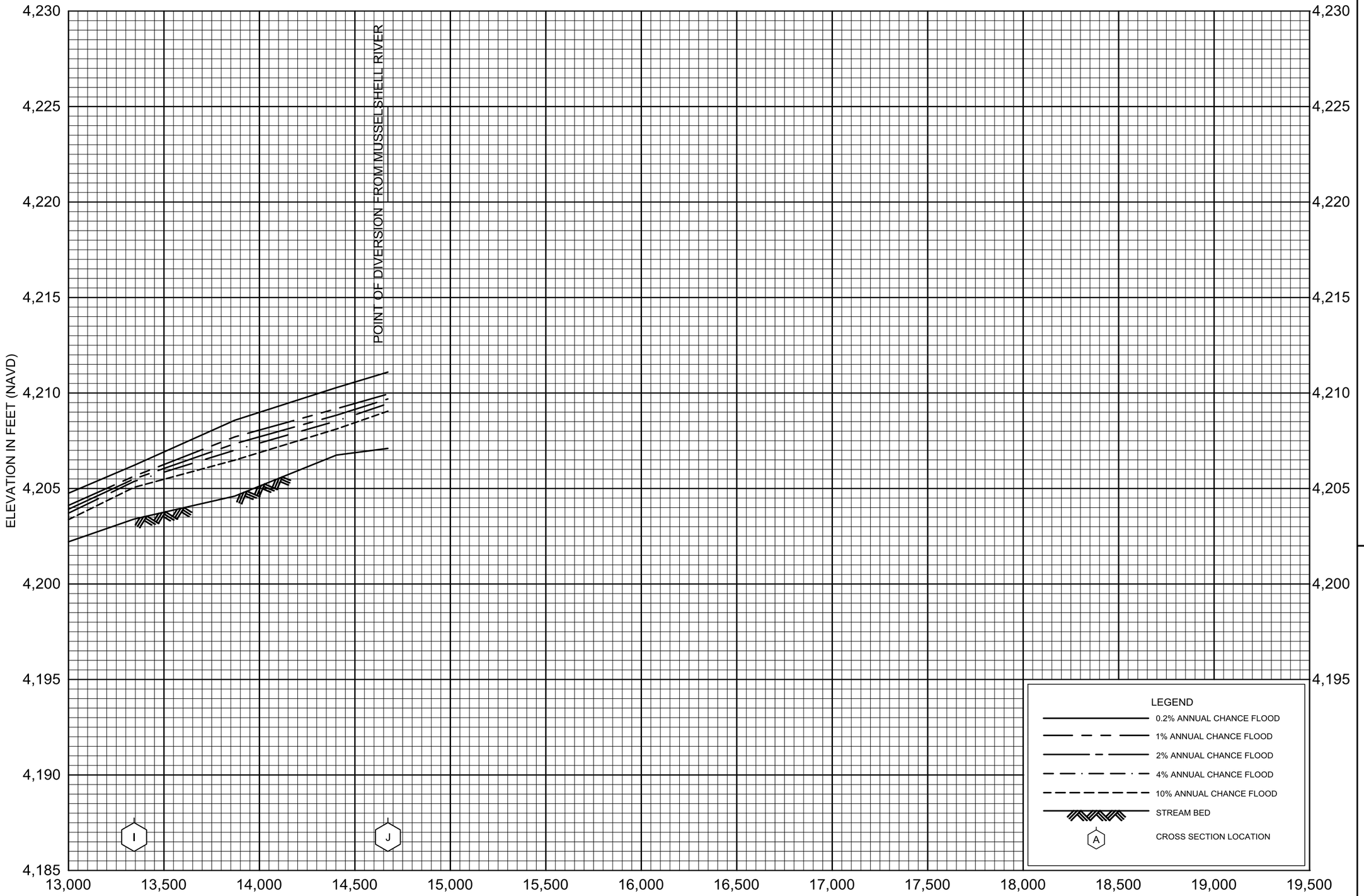
HARLOWTON OVERFLOW CHANNEL

FEDERAL EMERGENCY MANAGEMENT AGENCY

WHEATLAND COUNTY, MT

AND INCORPORATED AREAS

07P



FLOOD PROFILES

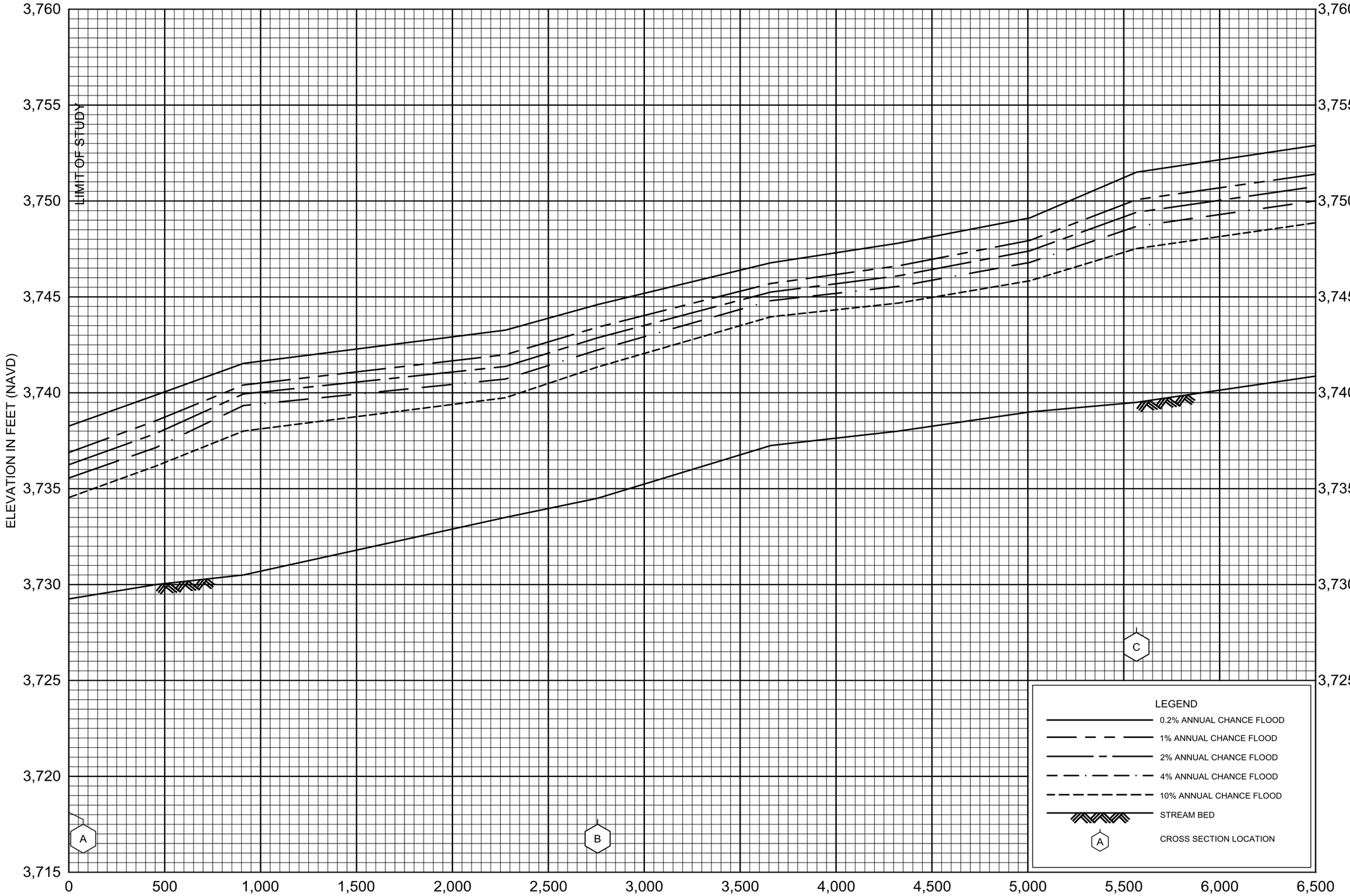
HARLOWTON OVERFLOW CHANNEL

FEDERAL EMERGENCY MANAGEMENT AGENCY

WHEATLAND COUNTY, MT

AND INCORPORATED AREAS

08P



FLOOD PROFILES

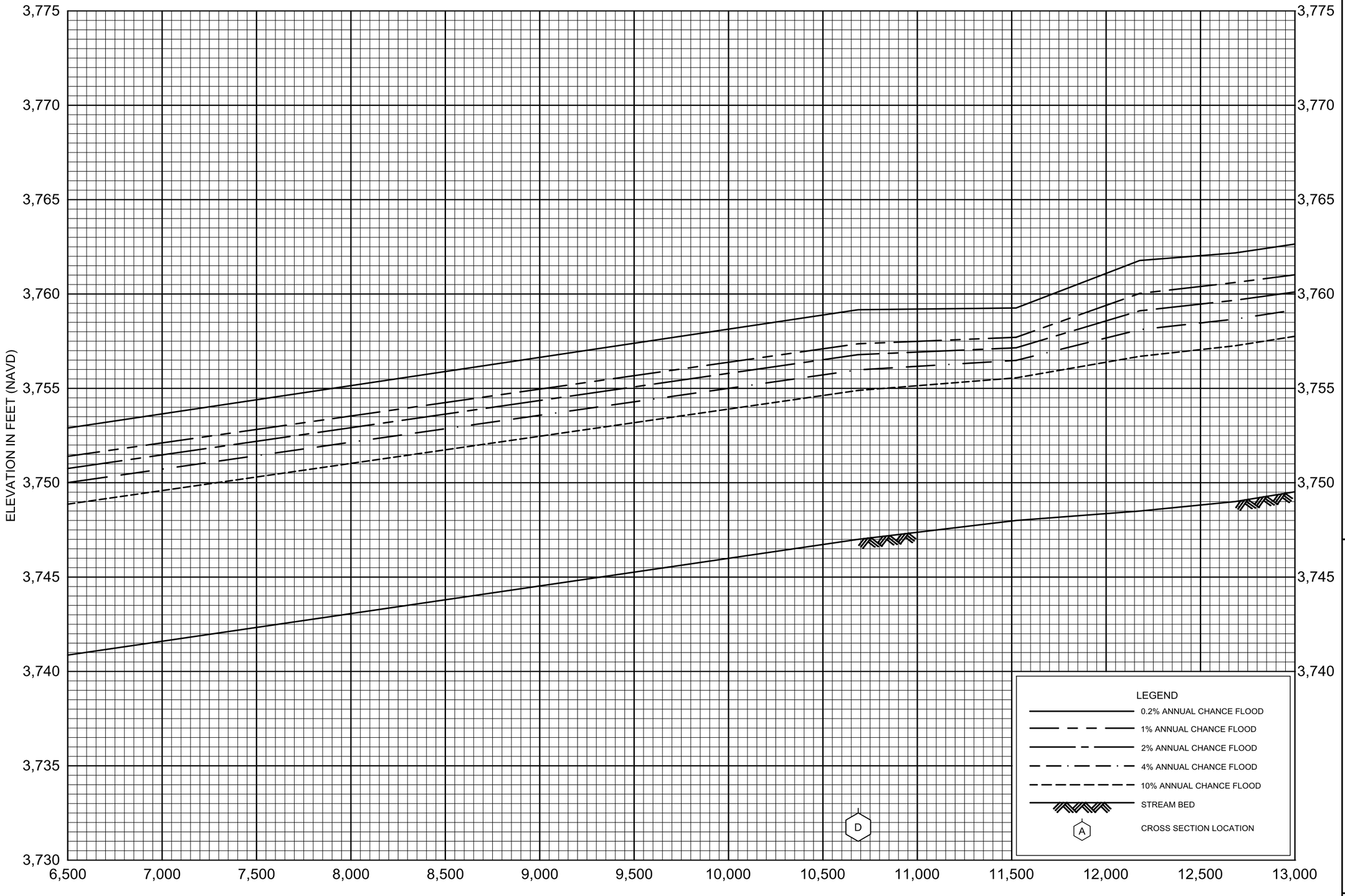
MUSSELSHELL RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

WHEATLAND COUNTY, MT

INCORPORATED

09P



FLOOD PROFILES

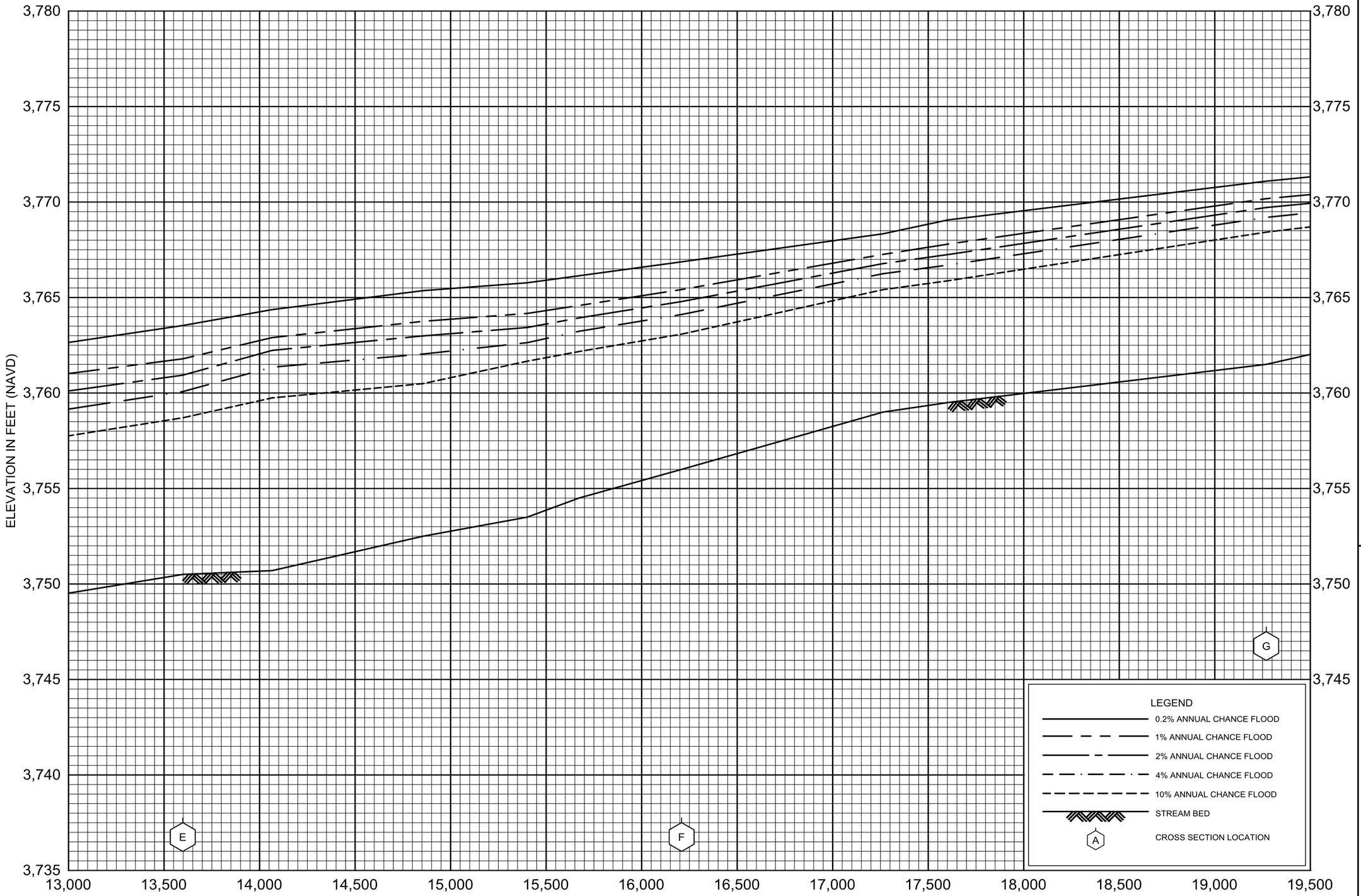
MUSSELSHELL RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

WHEATLAND COUNTY, MT

INCORPORATED

10P



FLOOD PROFILES

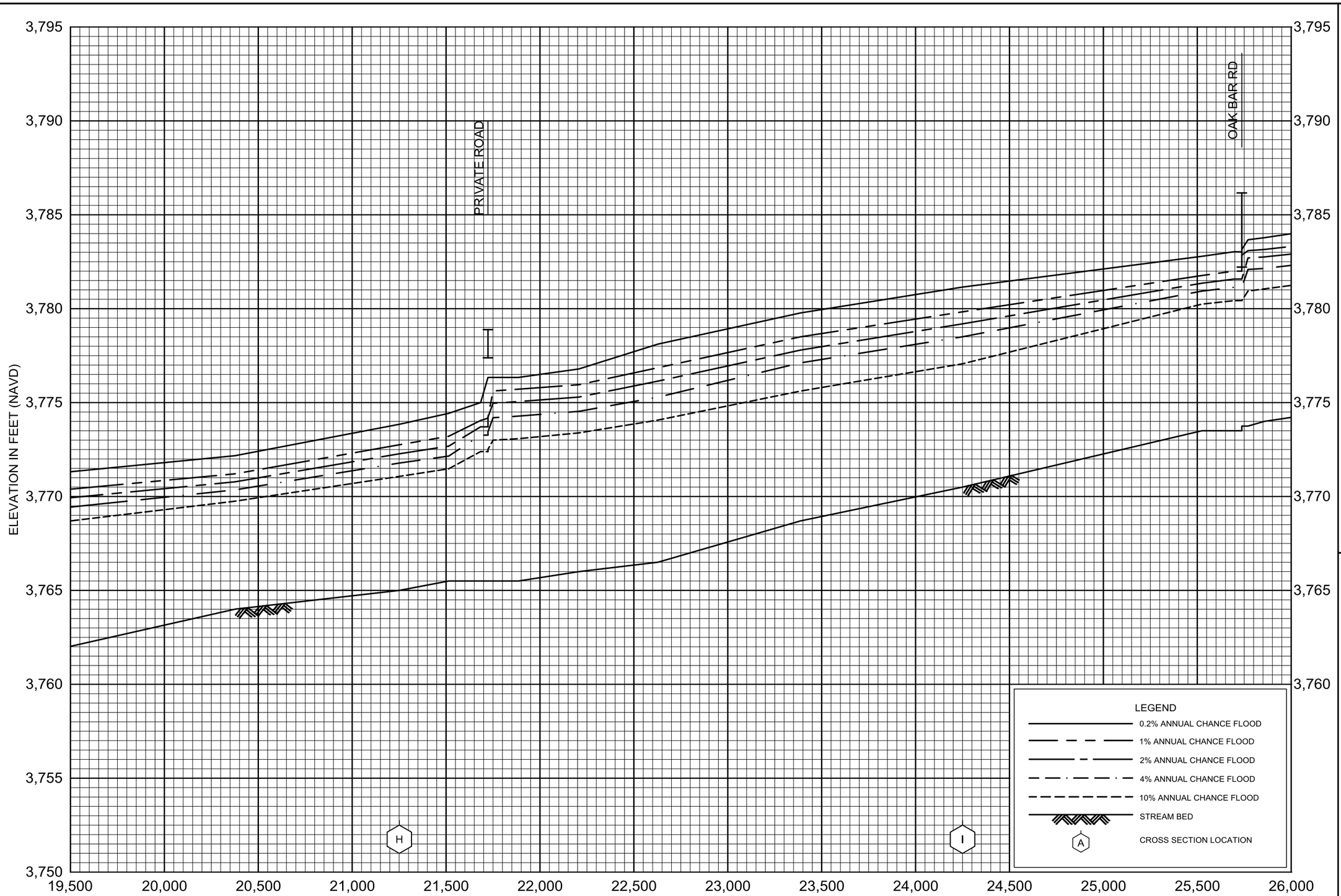
MUSSELSHELL RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

WHEATLAND COUNTY, MT

INCORPORATED

11P



FLOOD PROFILES

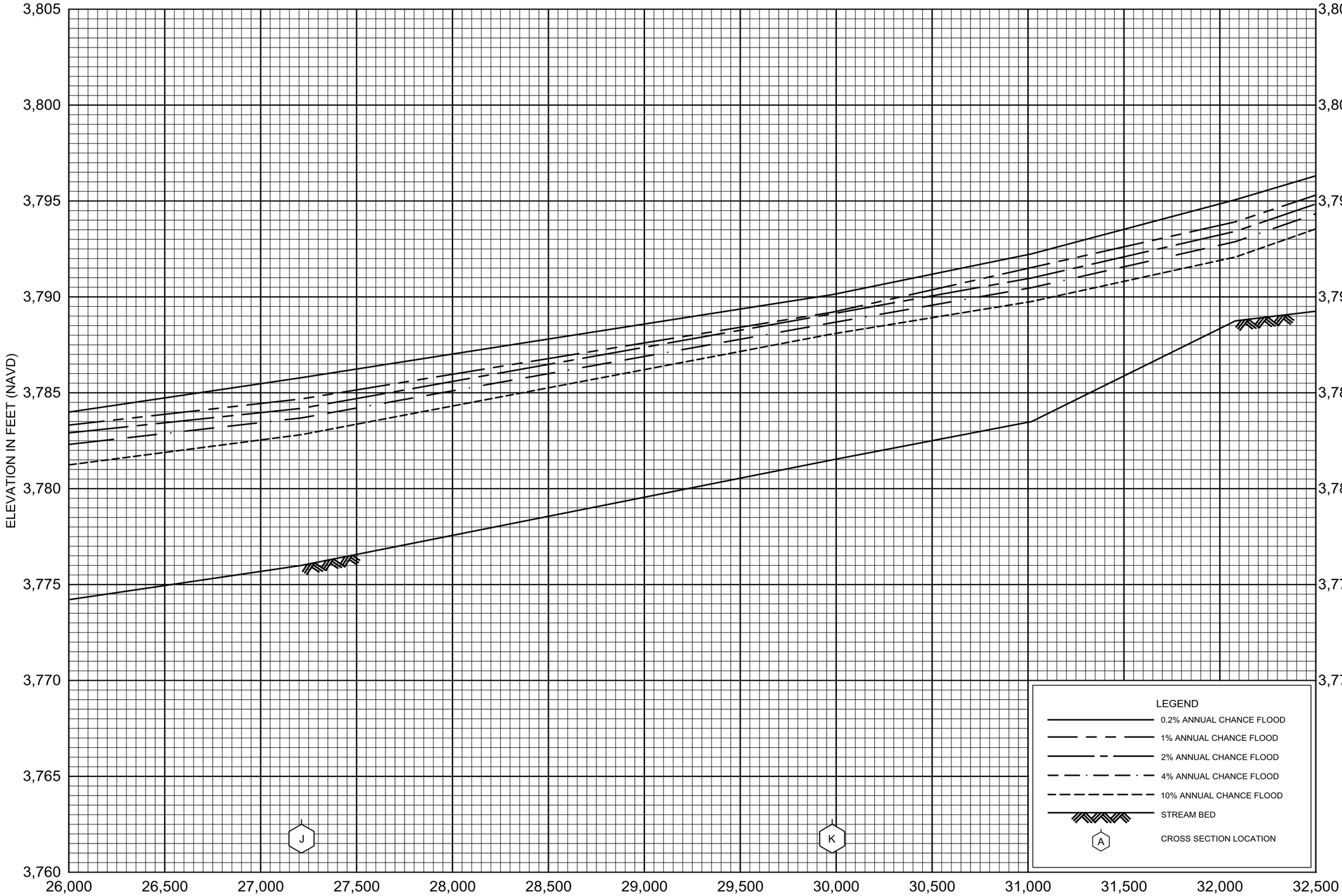
MUSSELSHELL RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

WHEATLAND COUNTY, MT

INCORPORATED

12P



FLOOD PROFILES

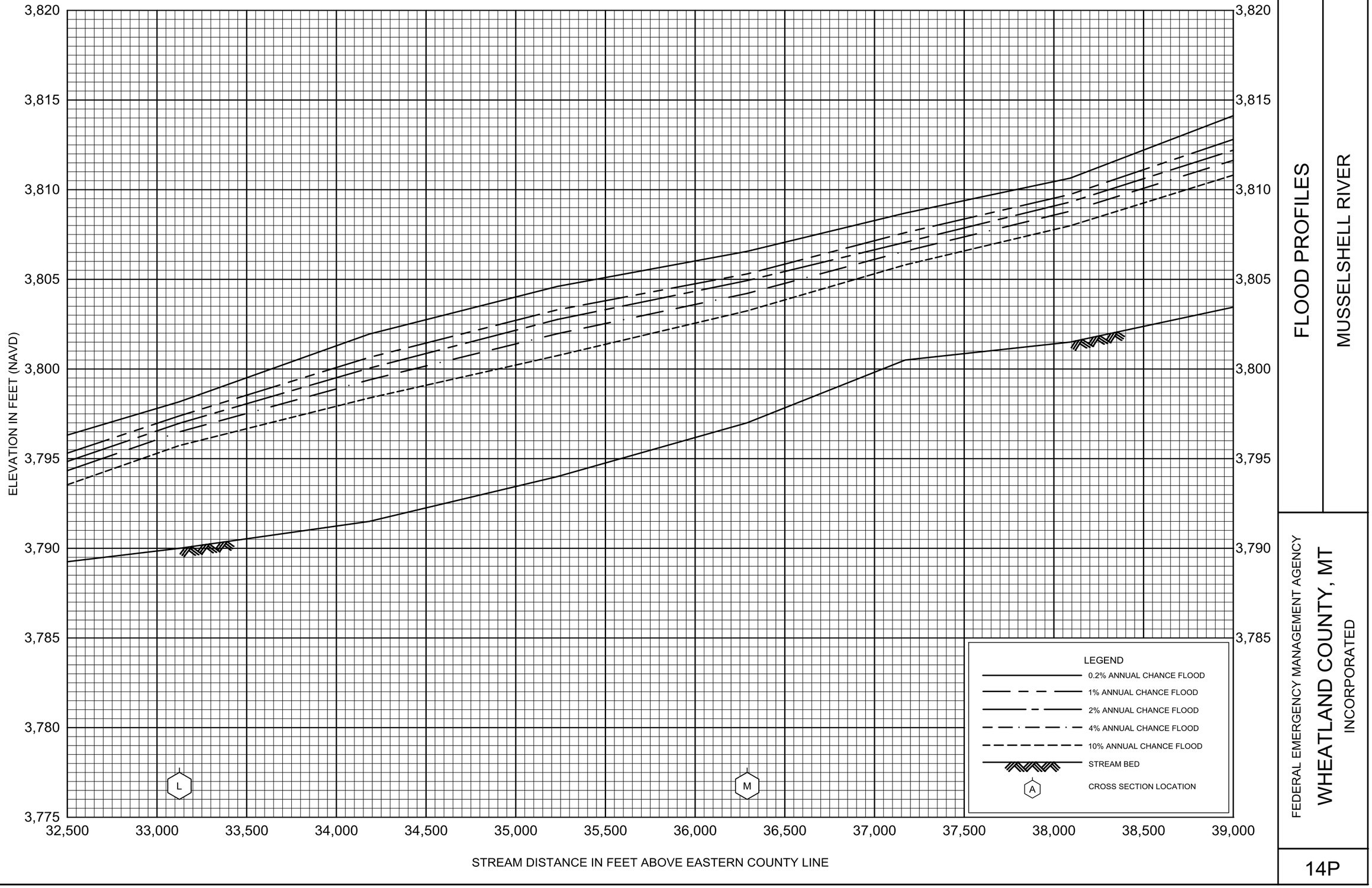
MUSSELSHELL RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

WHEATLAND COUNTY, MT

INCORPORATED

13P



FLOOD PROFILES

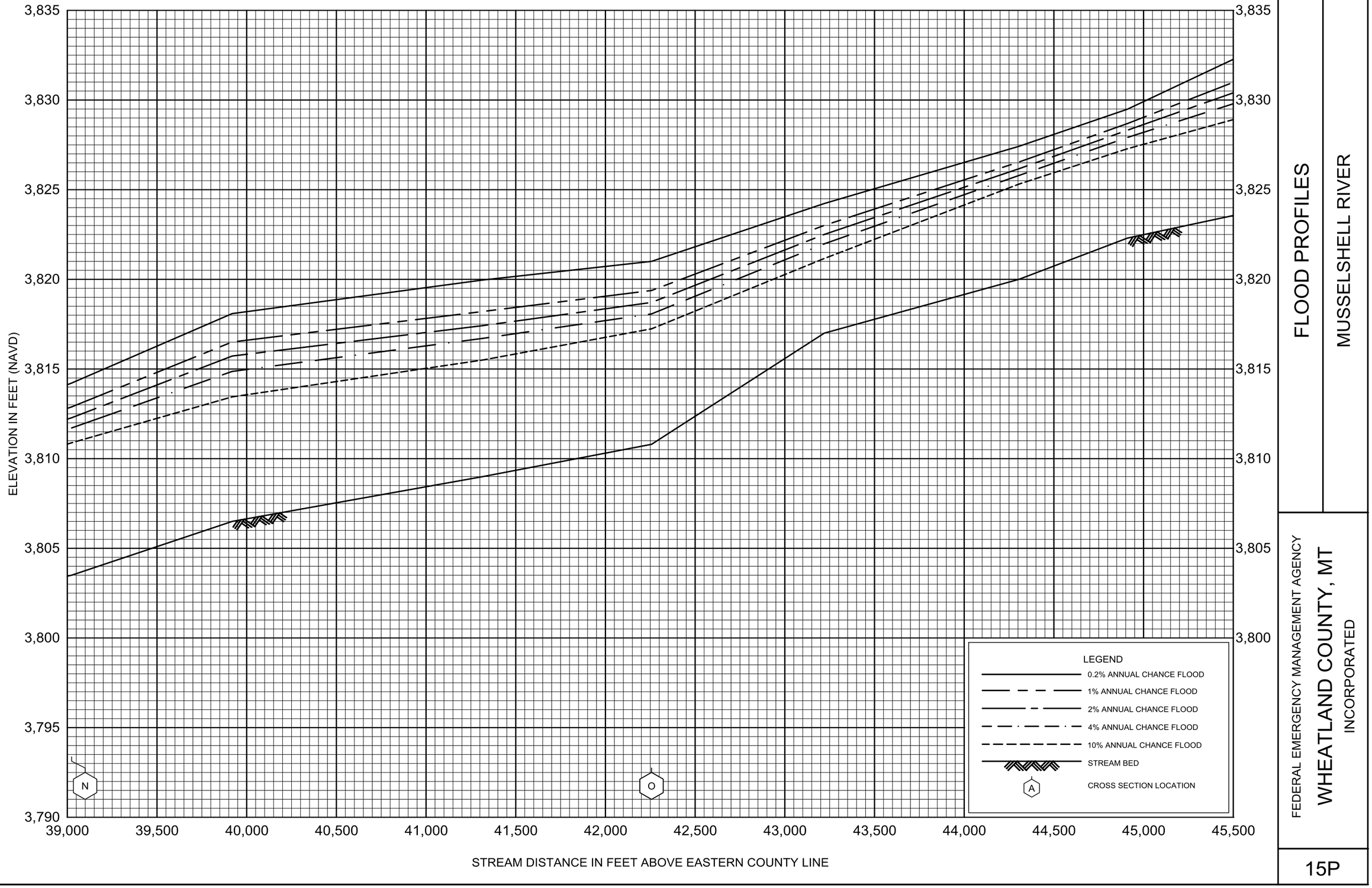
MUSSELSHELL RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

WHEATLAND COUNTY, MT

INCORPORATED

14P



FLOOD PROFILES

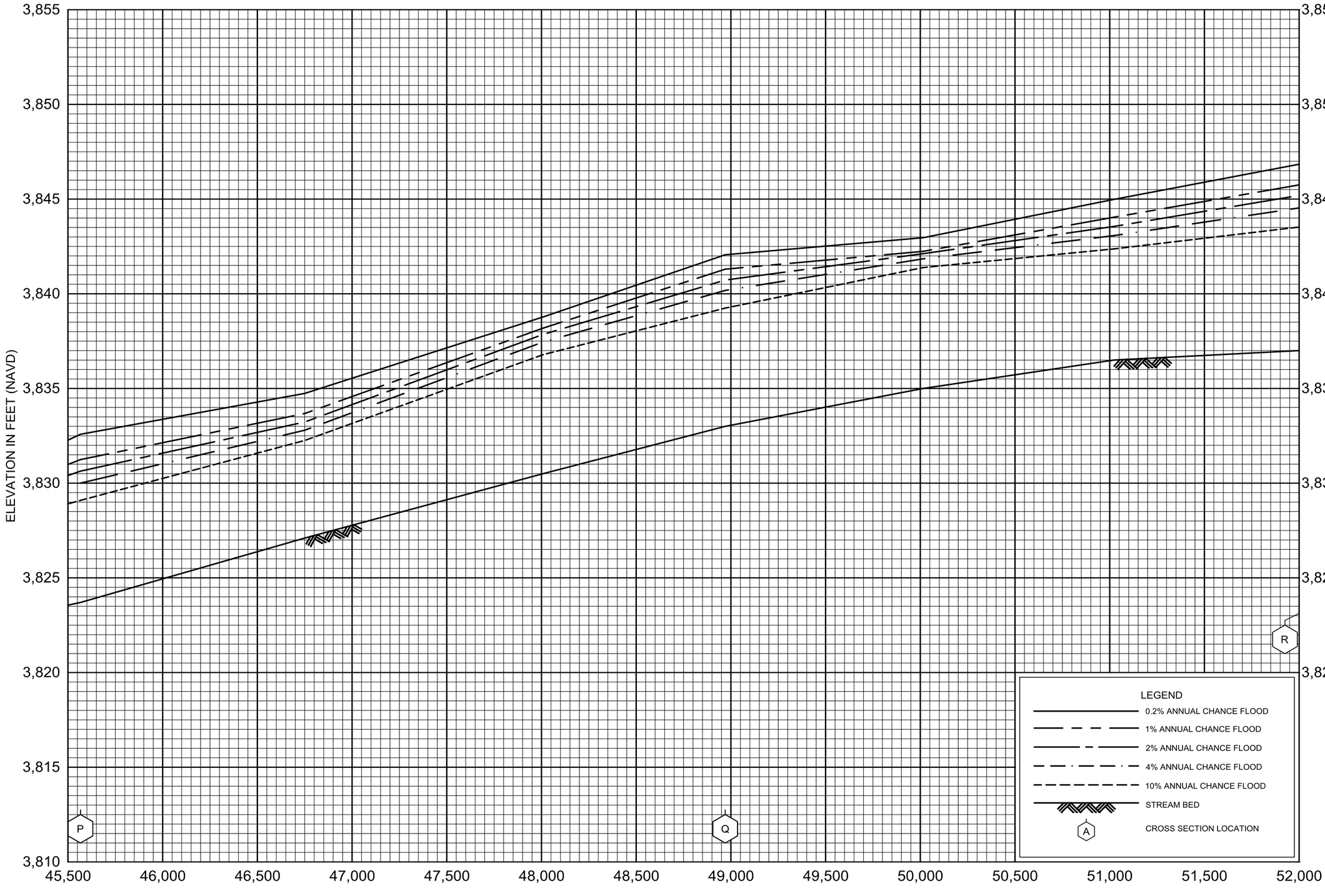
MUSSELSHELL RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

WHEATLAND COUNTY, MT

INCORPORATED

15P



FLOOD PROFILES

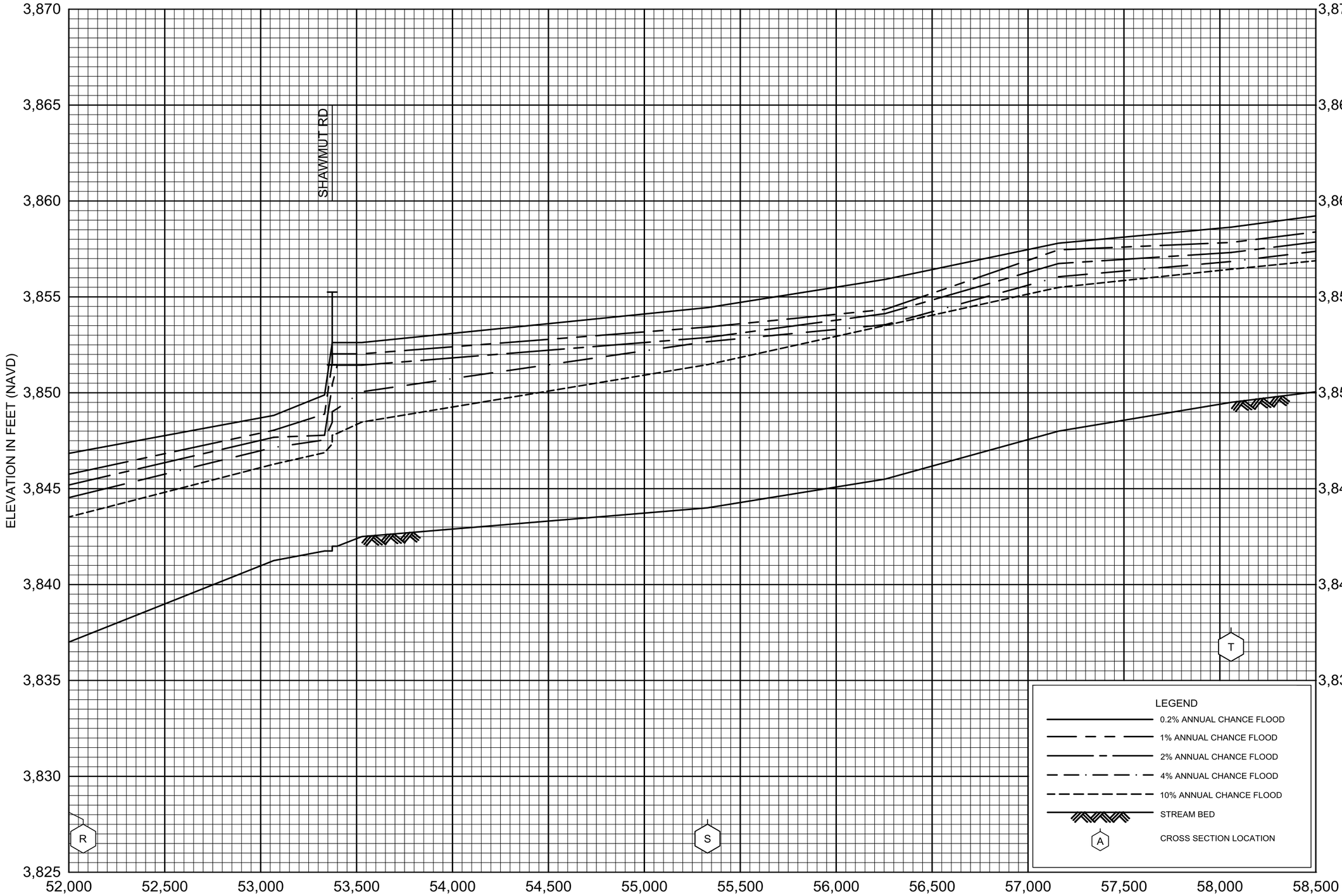
MUSSELSHELL RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

WHEATLAND COUNTY, MT

INCORPORATED

16P



FLOOD PROFILES

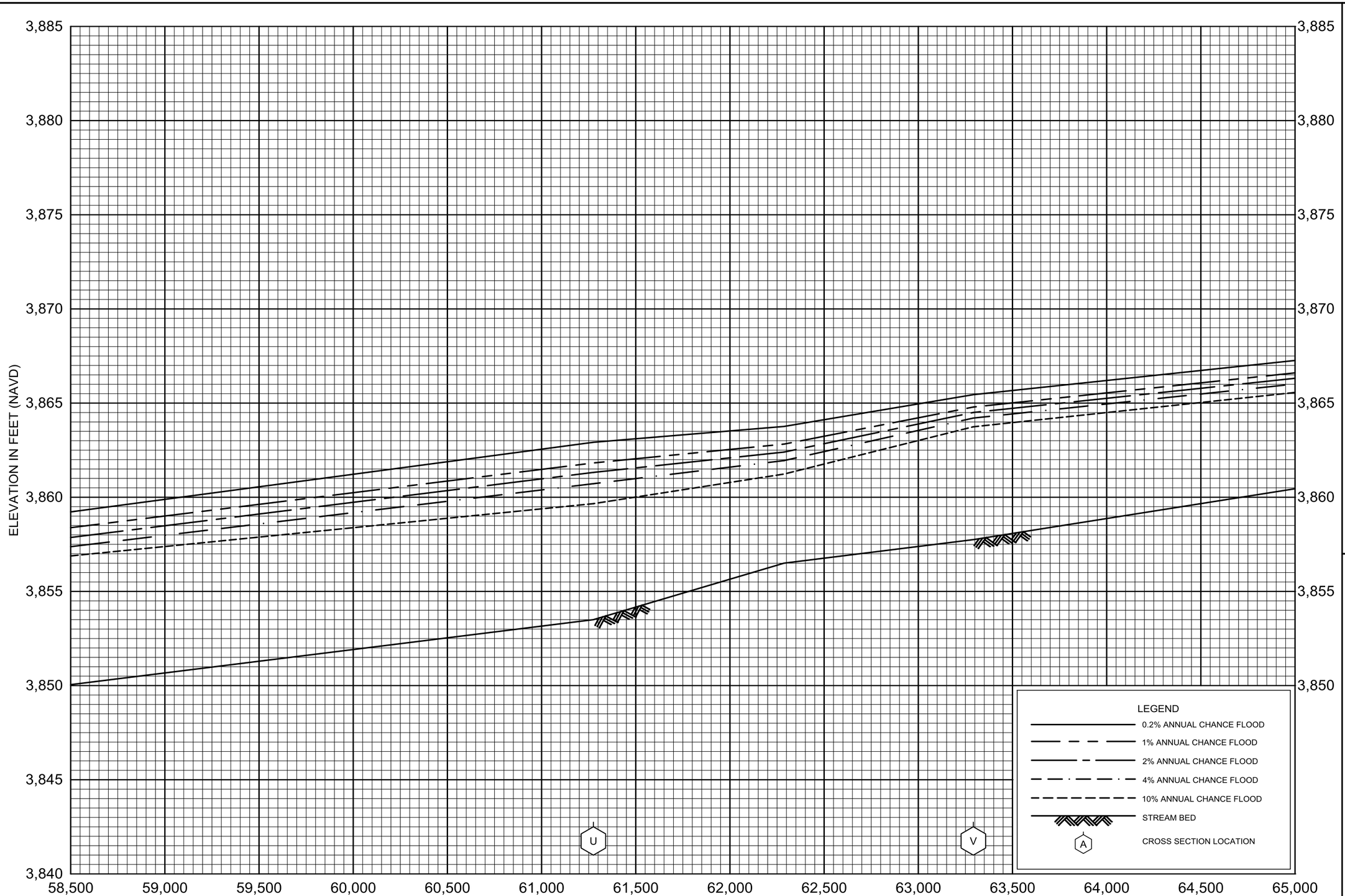
MUSSELSHELL RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

WHEATLAND COUNTY, MT

INCORPORATED

17P



FLOOD PROFILES

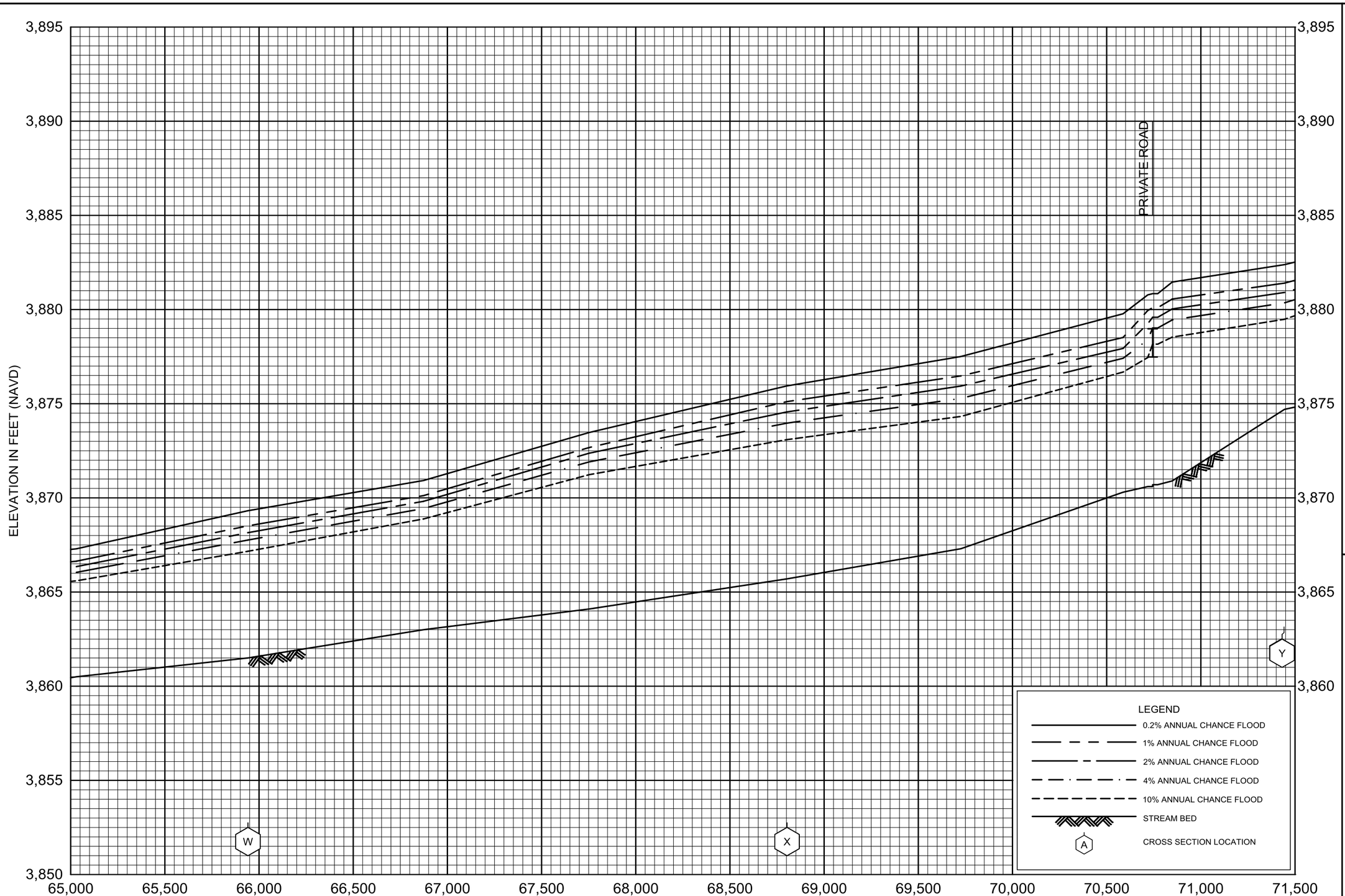
MUSSELSHELL RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

WHEATLAND COUNTY, MT

INCORPORATED

18P



FLOOD PROFILES

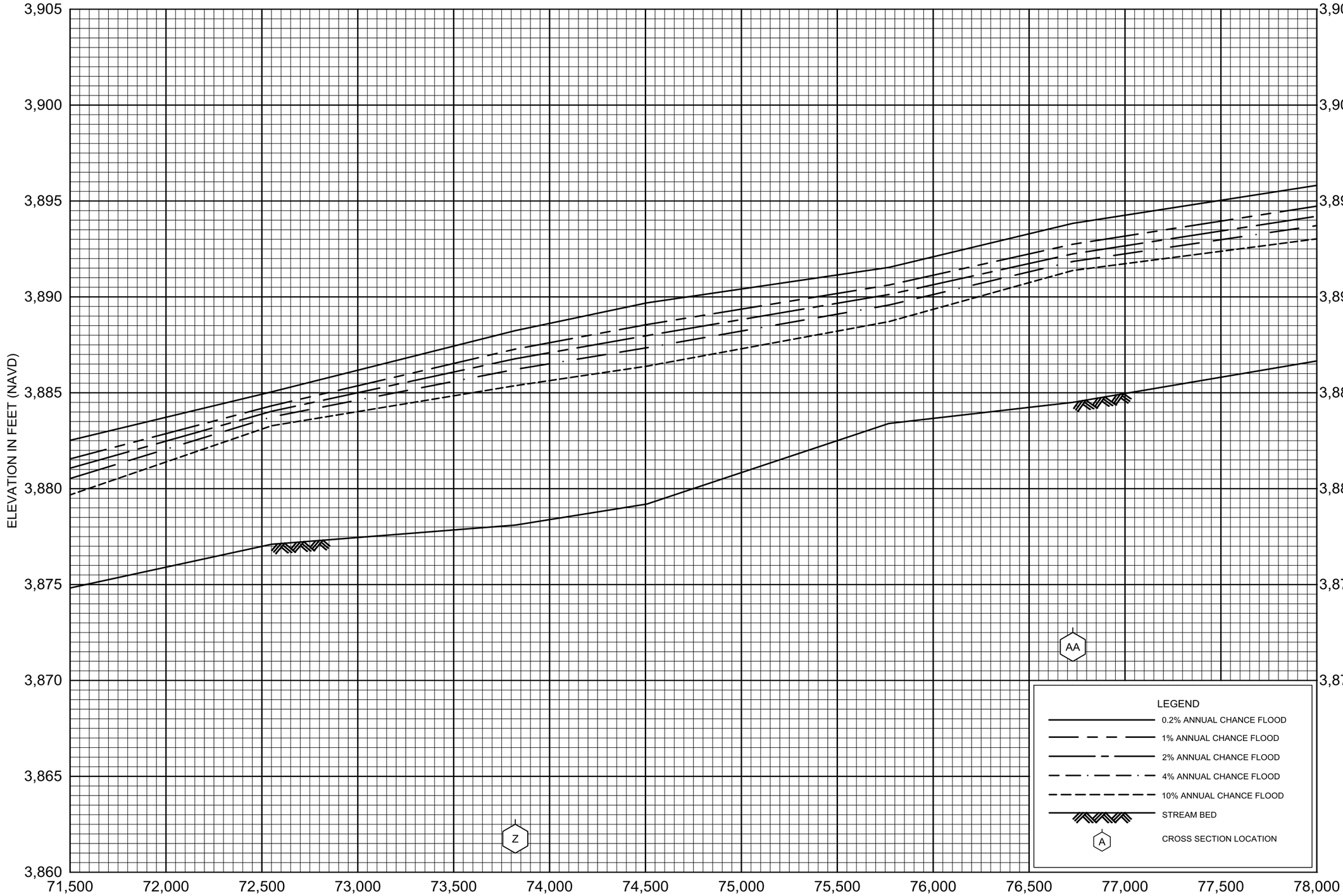
MUSSELSHELL RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

WHEATLAND COUNTY, MT

INCORPORATED

19P



FLOOD PROFILES

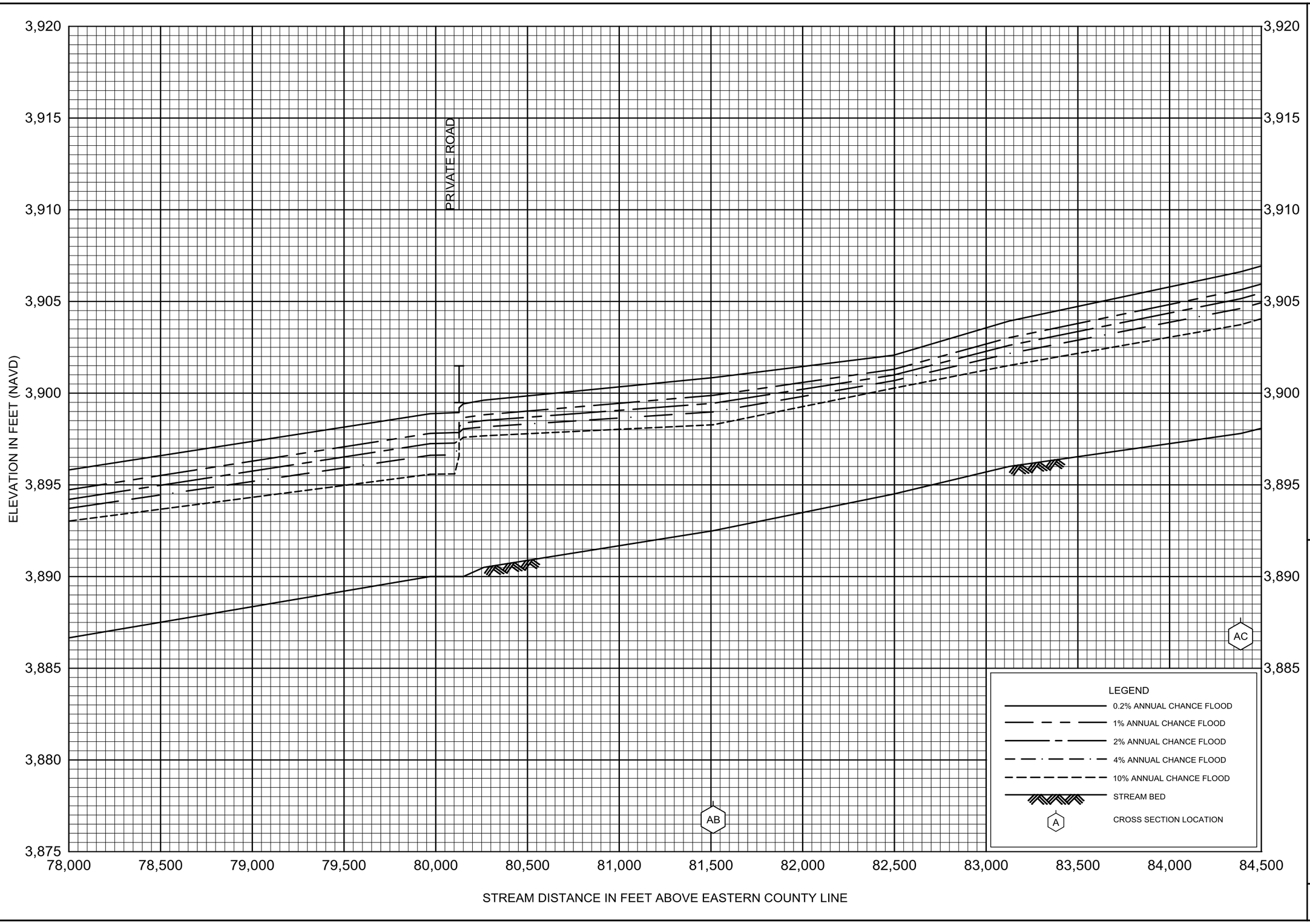
MUSSELSHELL RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

WHEATLAND COUNTY, MT

INCORPORATED

20P



FLOOD PROFILES

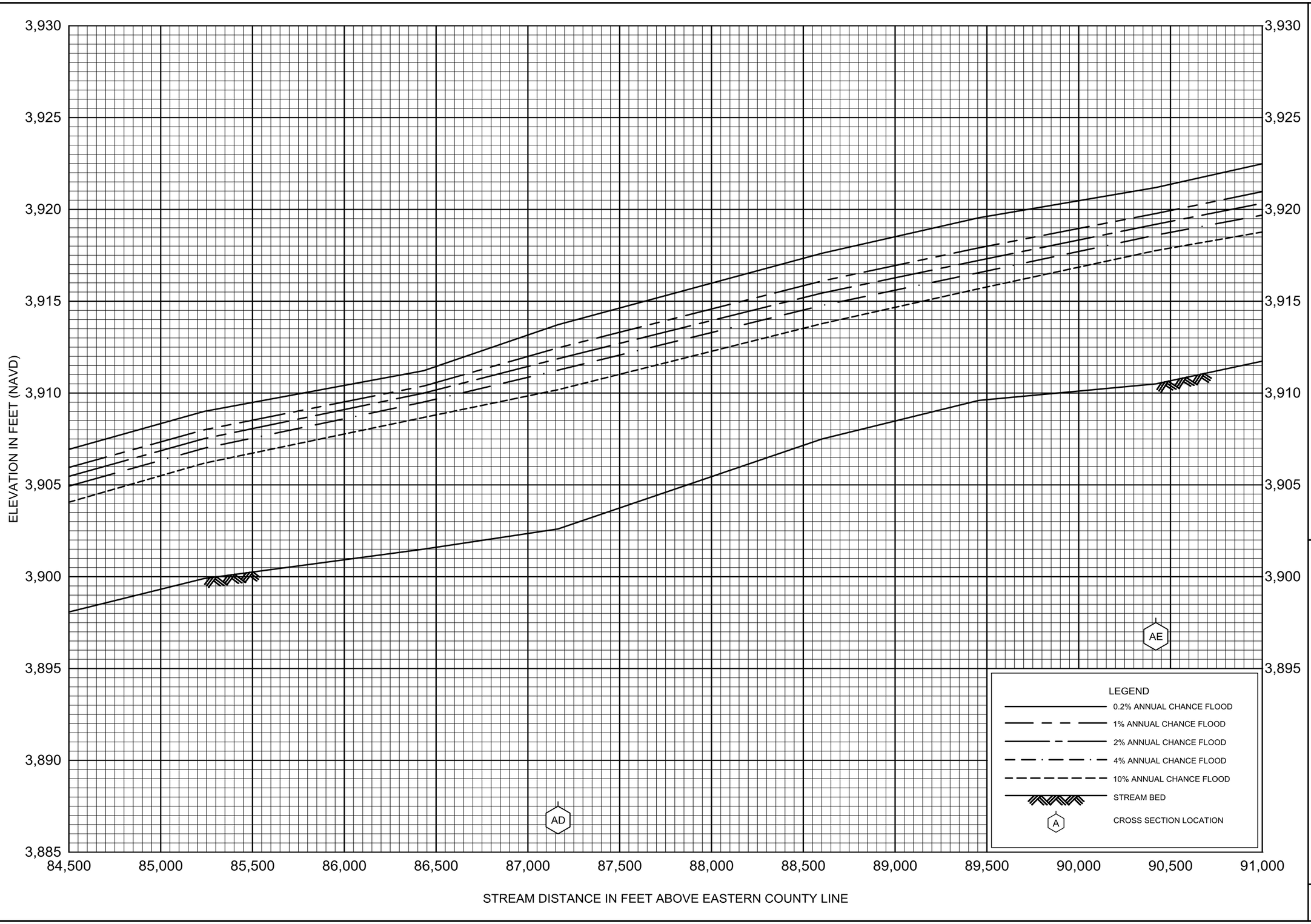
MUSSELSHELL RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

WHEATLAND COUNTY, MT

INCORPORATED

21P



FLOOD PROFILES

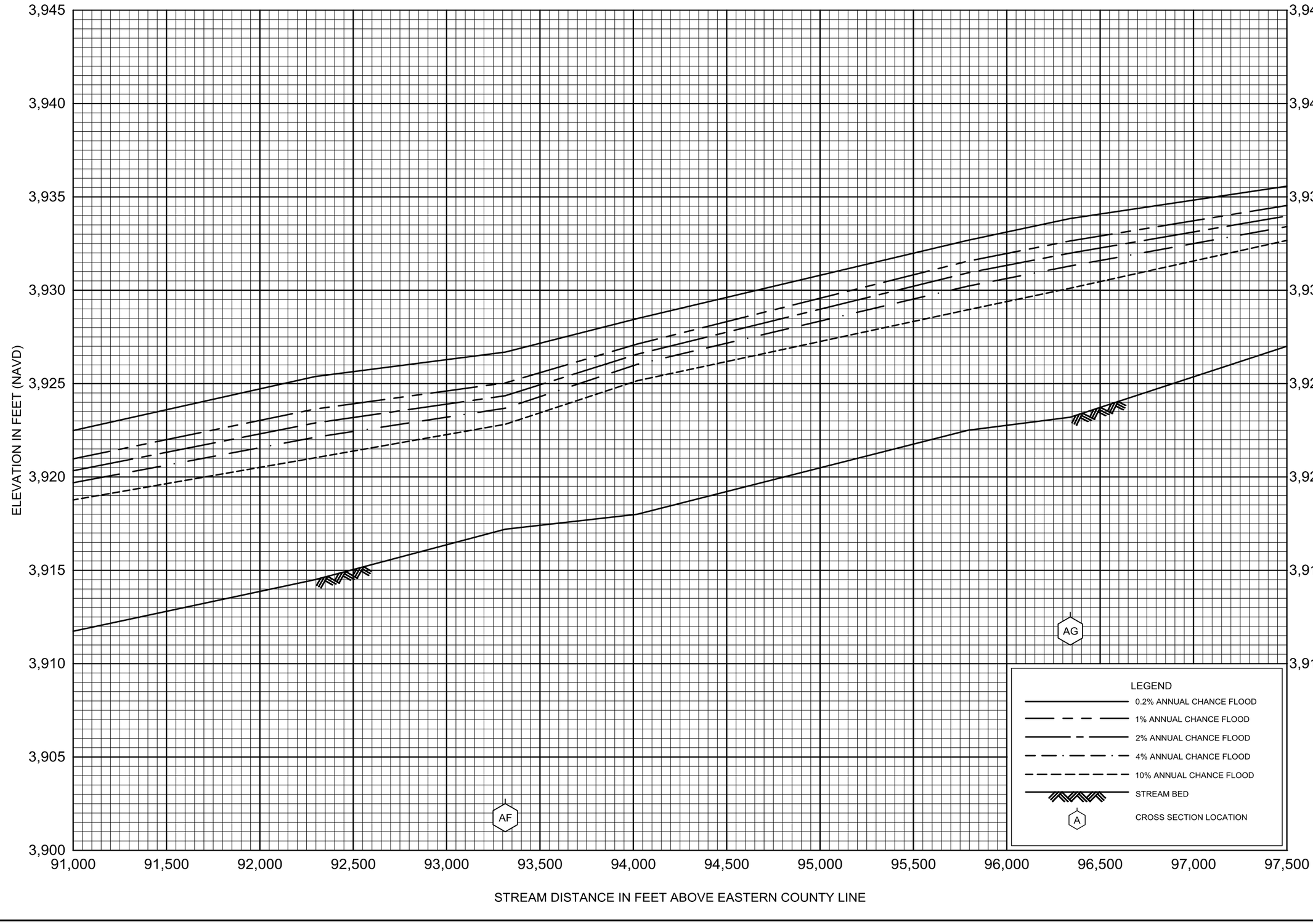
MUSSELSHELL RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

WHEATLAND COUNTY, MT

INCORPORATED

22P



FLOOD PROFILES

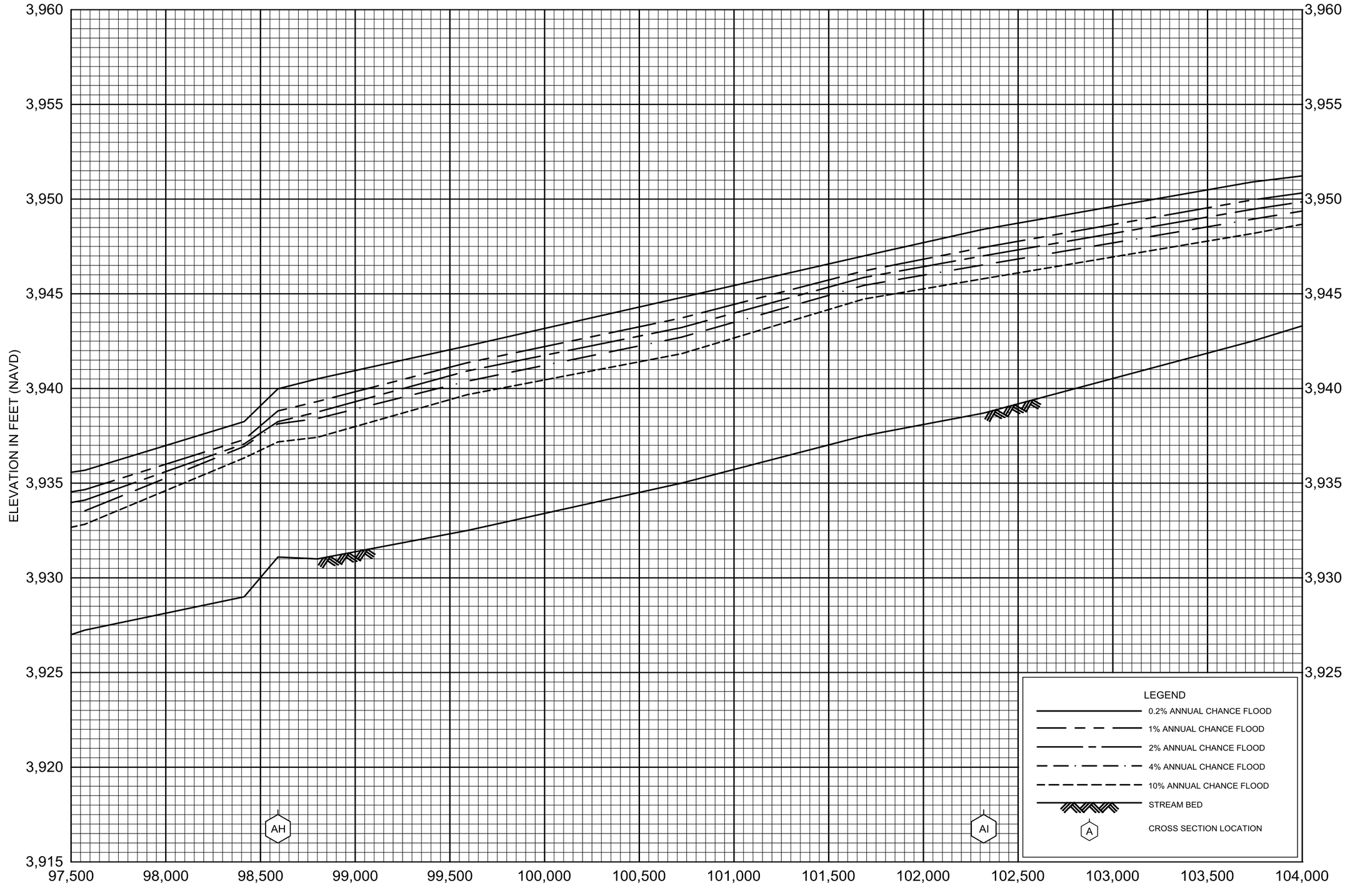
MUSSELSHELL RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

WHEATLAND COUNTY, MT

INCORPORATED

23P



FLOOD PROFILES

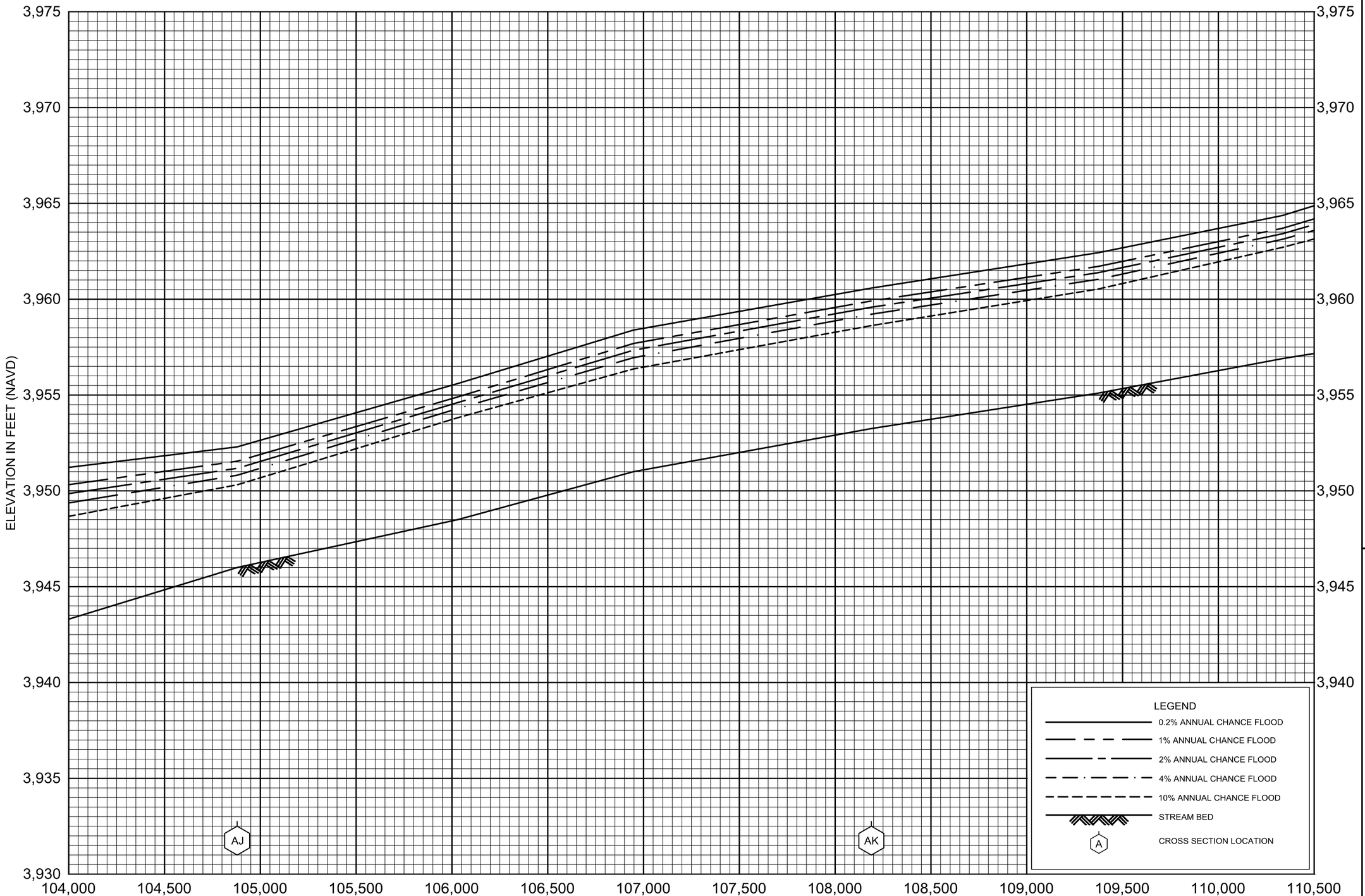
MUSSELSHELL RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

WHEATLAND COUNTY, MT

INCORPORATED

24P



FLOOD PROFILES

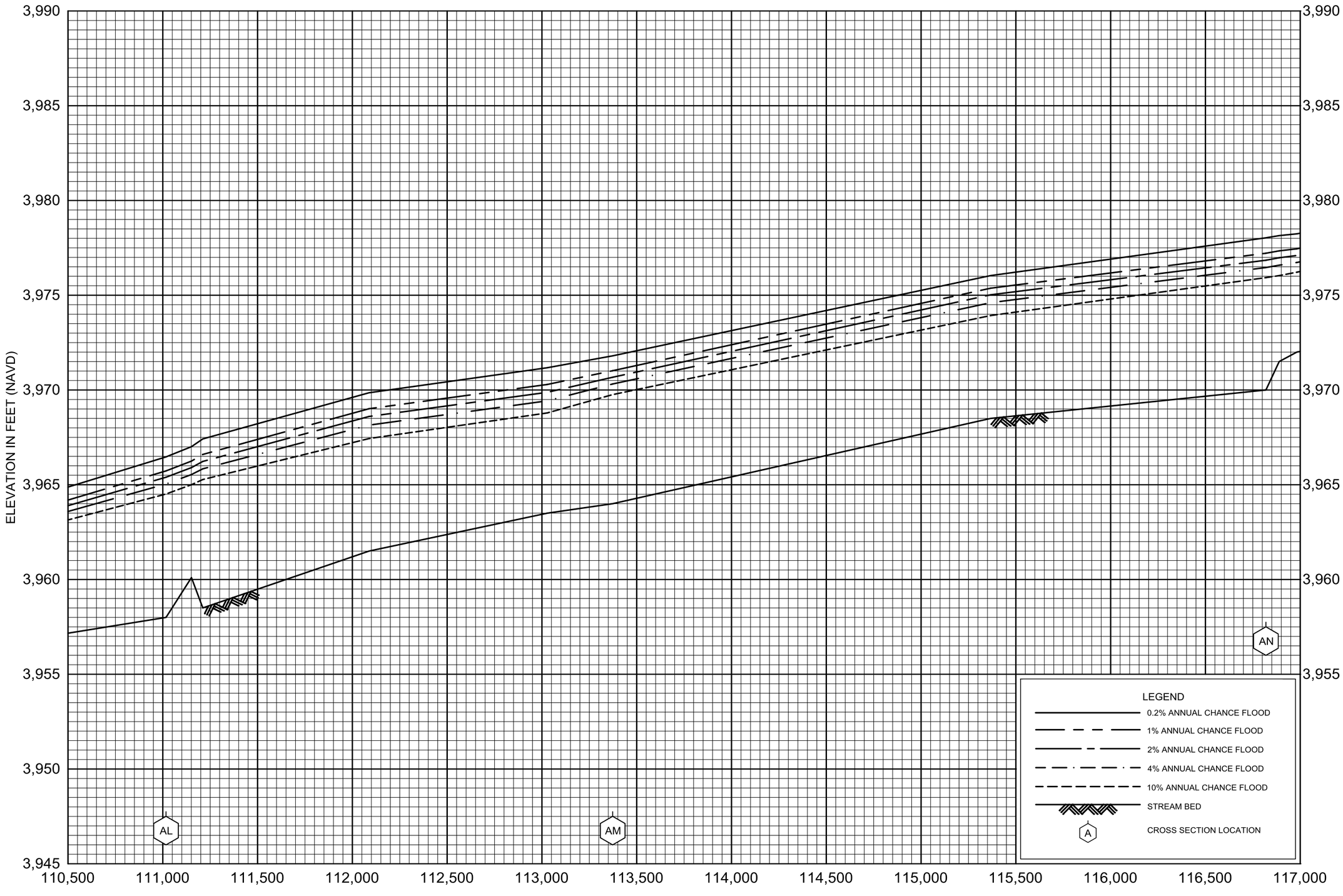
MUSSELSHELL RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

WHEATLAND COUNTY, MT

INCORPORATED

25P



FLOOD PROFILES

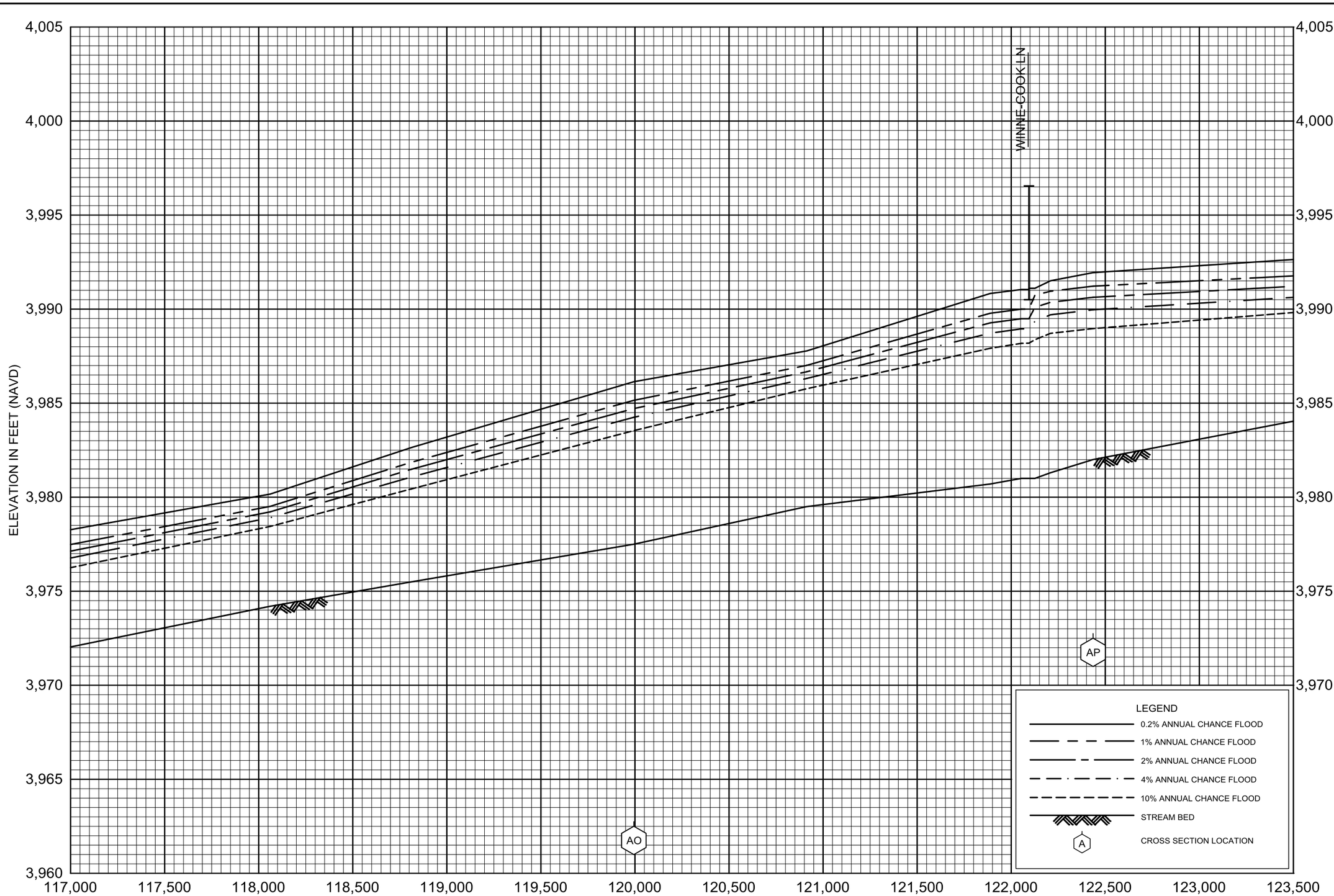
MUSSELSHELL RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

WHEATLAND COUNTY, MT

INCORPORATED

26P



FLOOD PROFILES

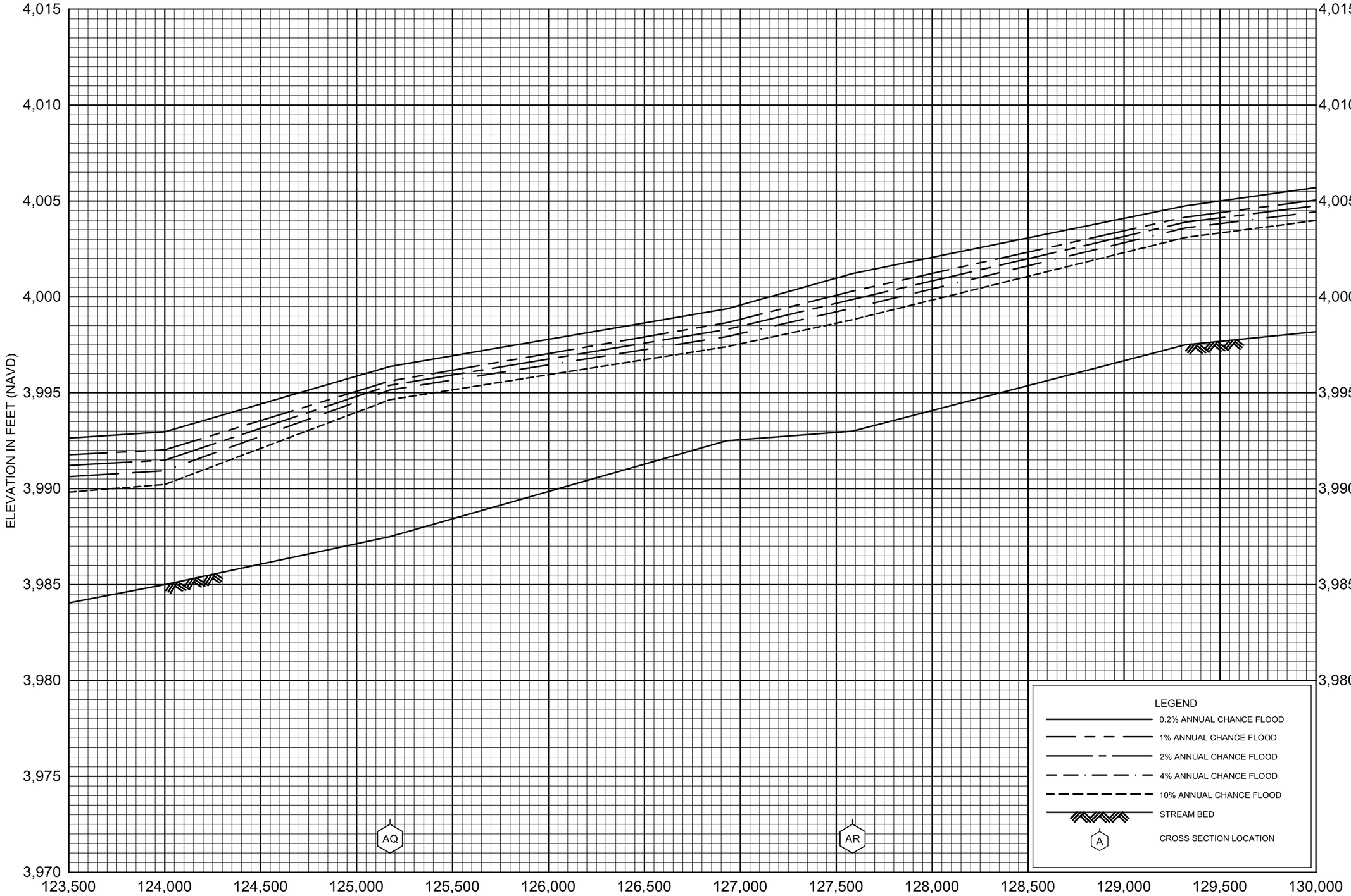
MUSSELSHELL RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

WHEATLAND COUNTY, MT

INCORPORATED

27P



FLOOD PROFILES

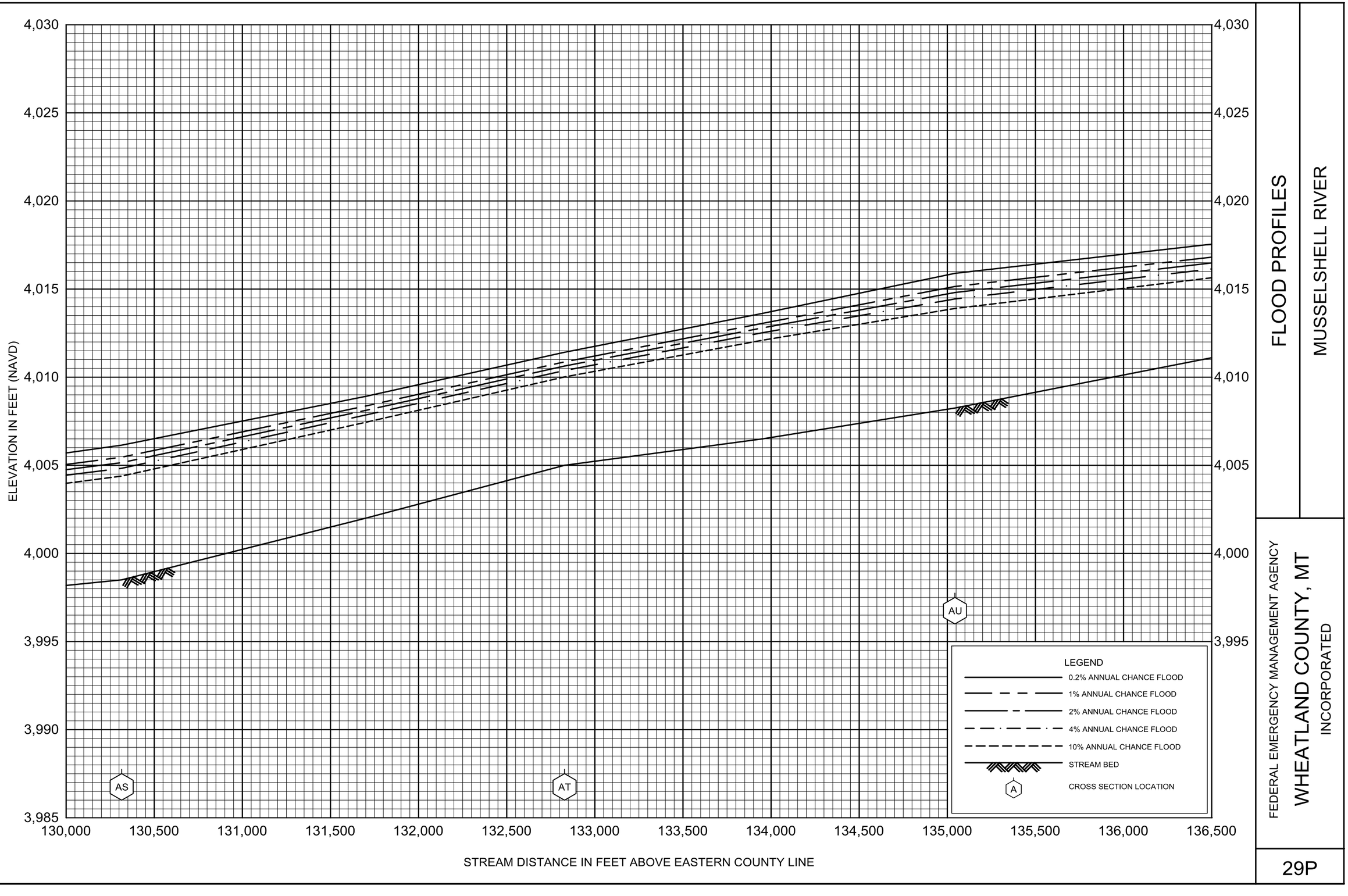
MUSSELSHELL RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

WHEATLAND COUNTY, MT

INCORPORATED

28P



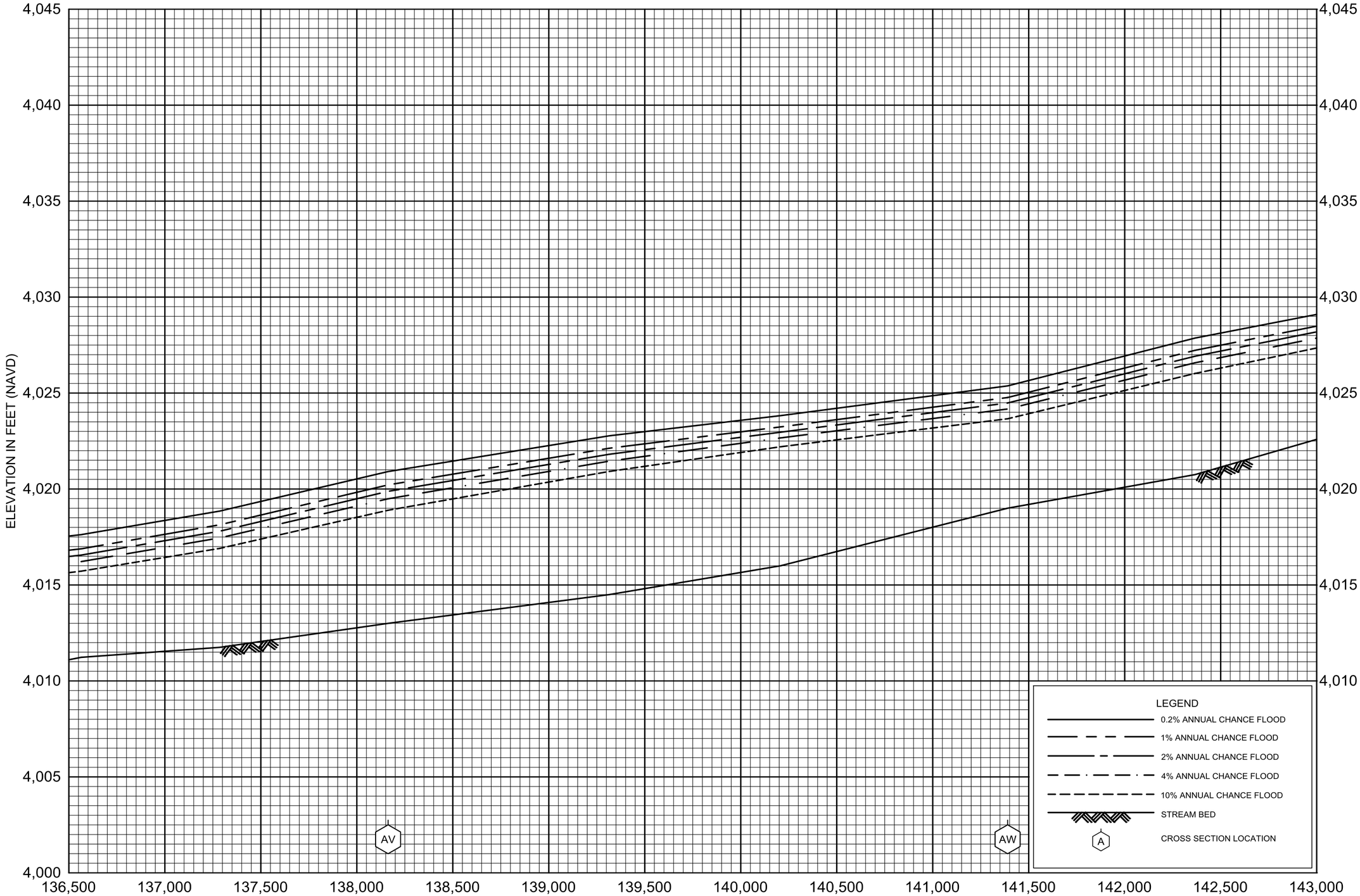
FLOOD PROFILES

MUSSELSHELL RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

WHEATLAND COUNTY, MT

INCORPORATED



FLOOD PROFILES

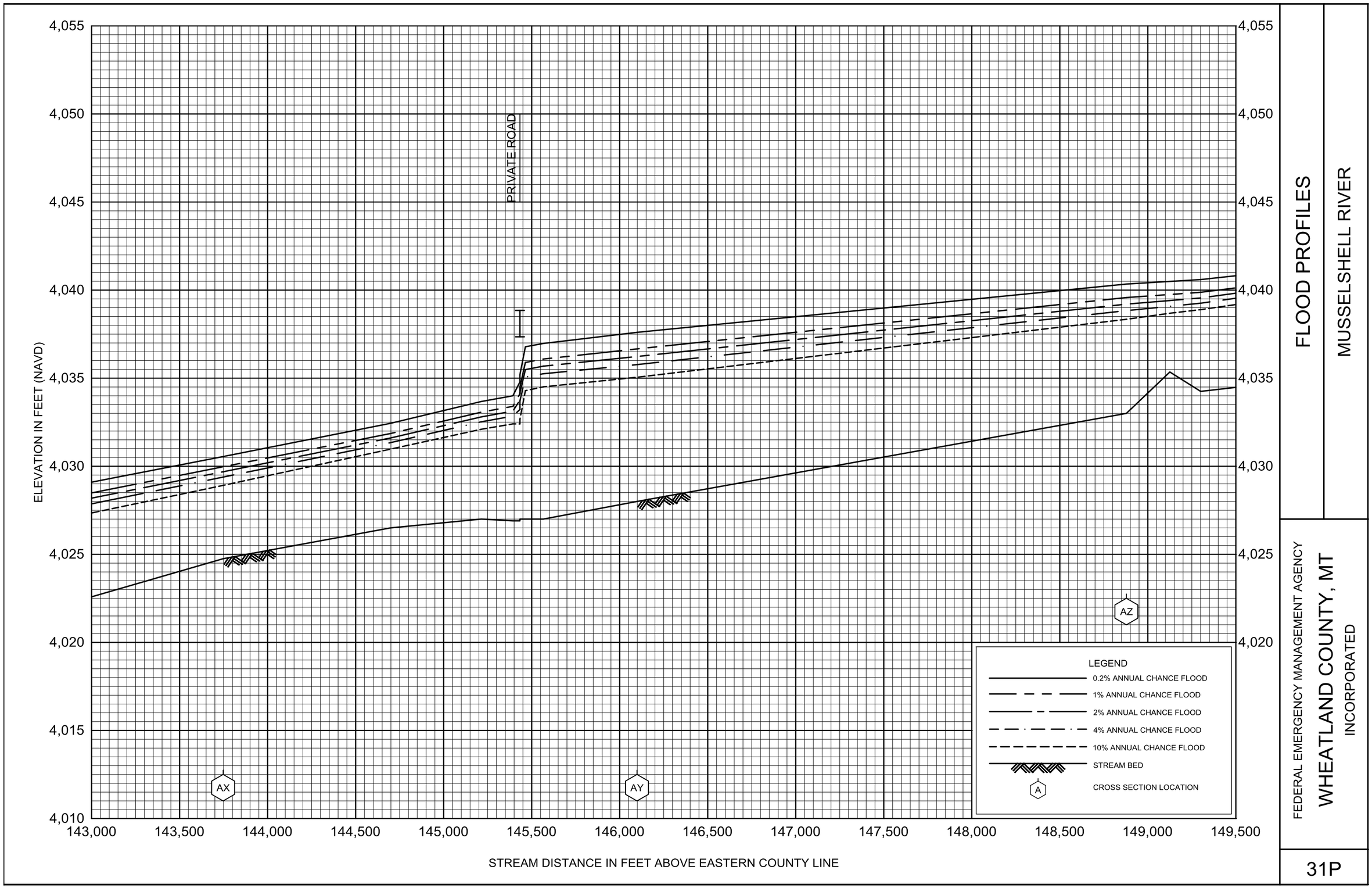
MUSSELSHELL RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

WHEATLAND COUNTY, MT

INCORPORATED

30P



FLOOD PROFILES

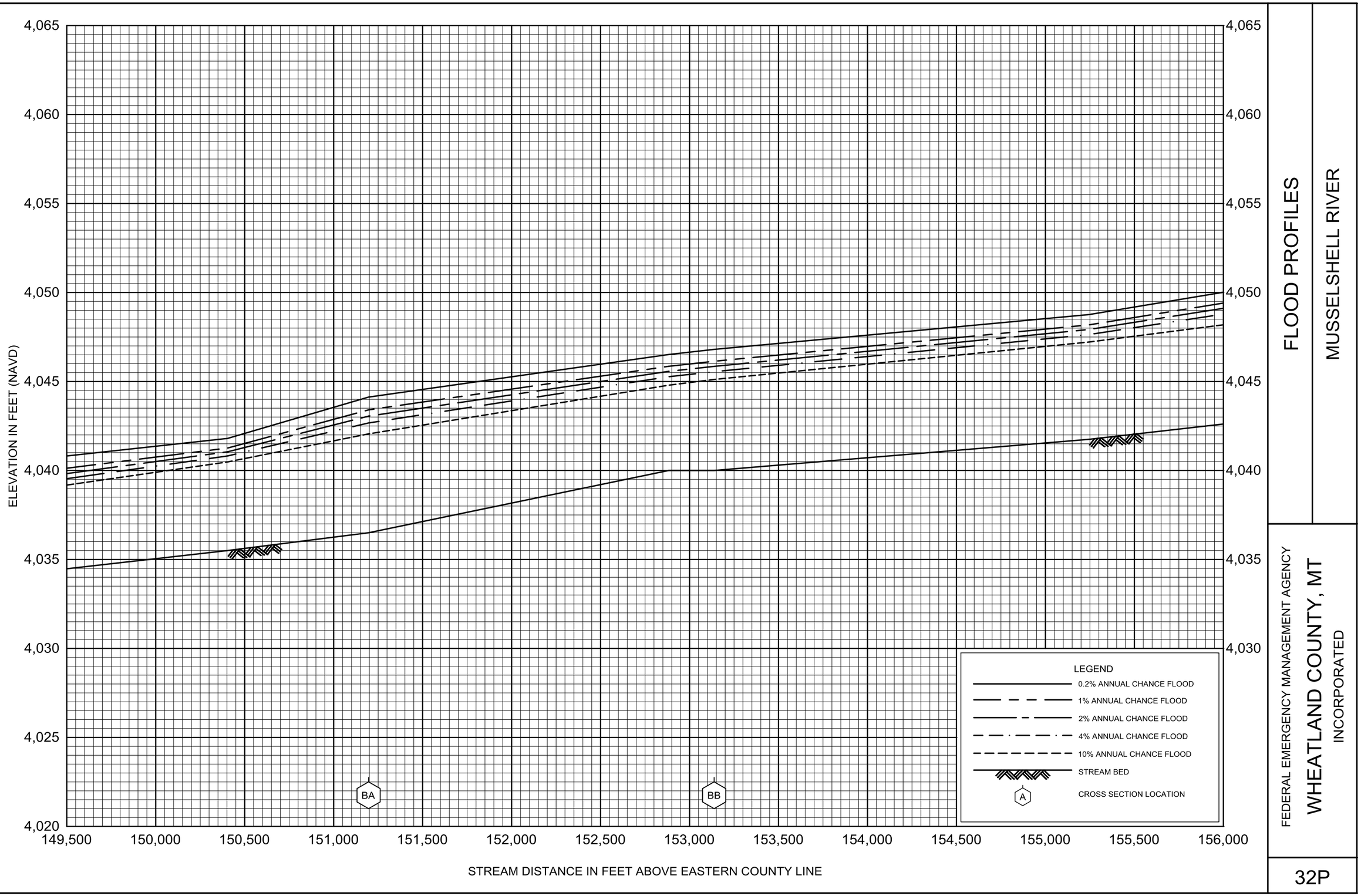
MUSSELSHELL RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

WHEATLAND COUNTY, MT

INCORPORATED

31P



FLOOD PROFILES

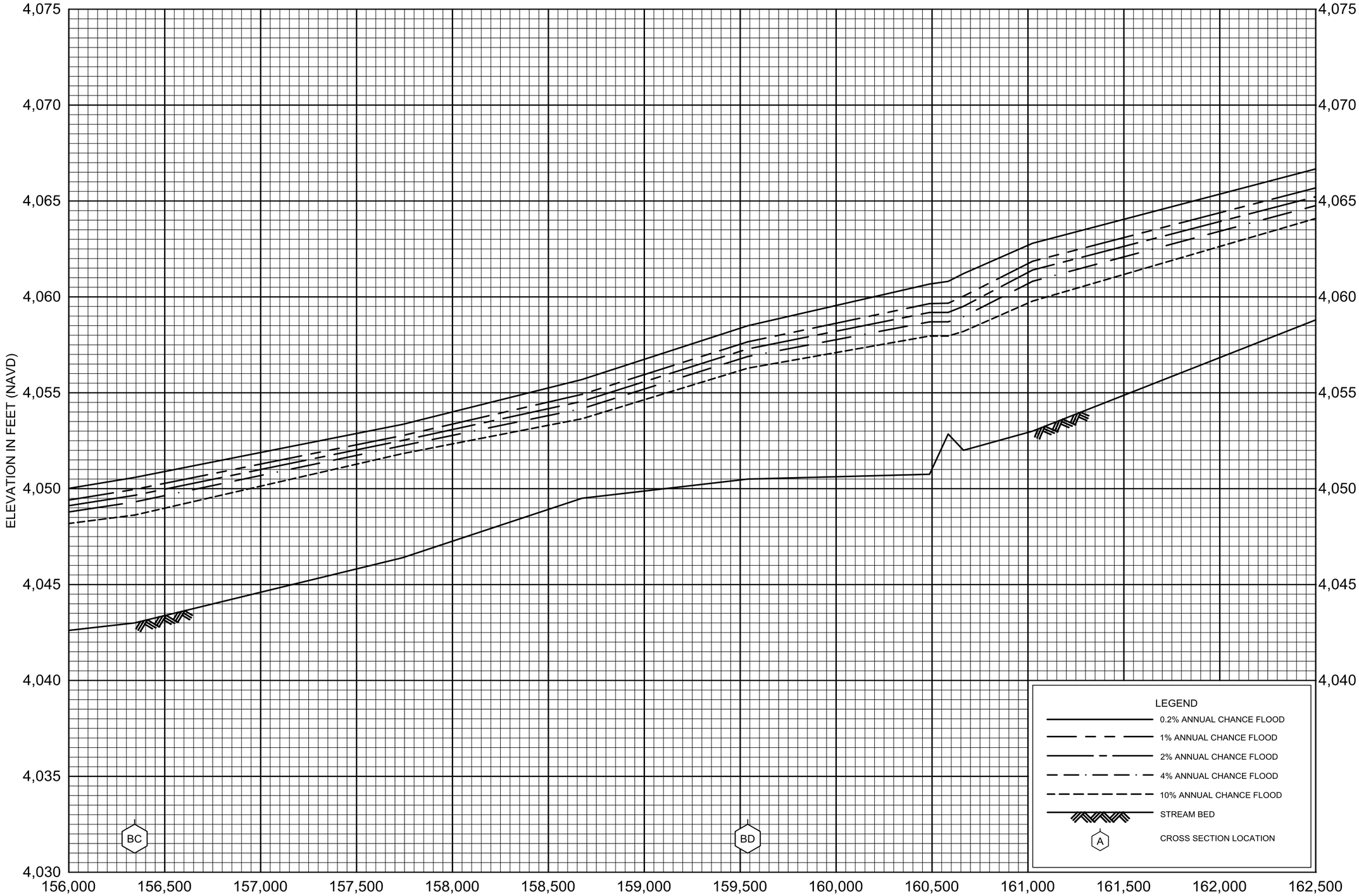
MUSSELSHELL RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

WHEATLAND COUNTY, MT

INCORPORATED

32P



FLOOD PROFILES

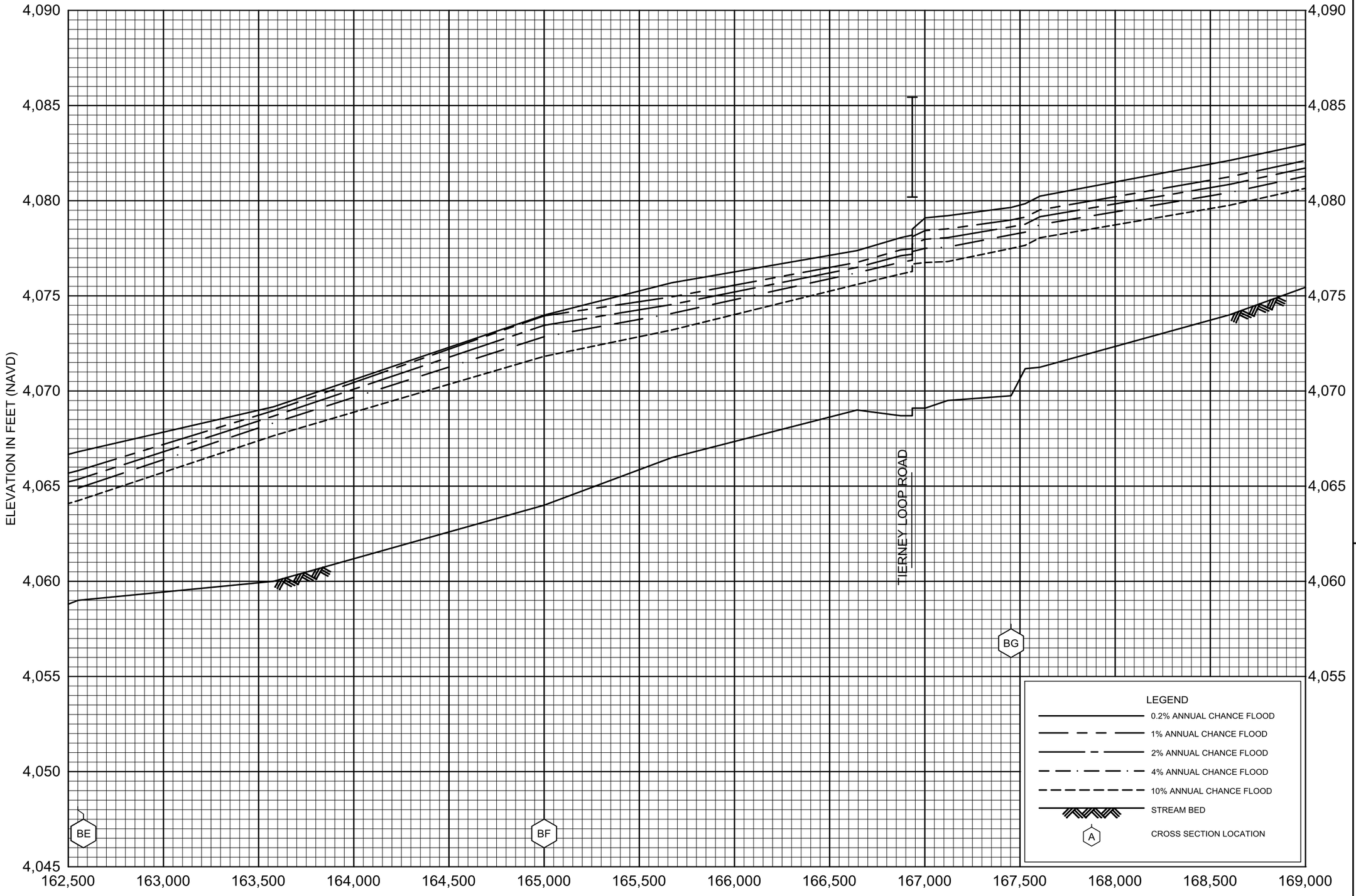
MUSSELSHELL RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

WHEATLAND COUNTY, MT

INCORPORATED

33P



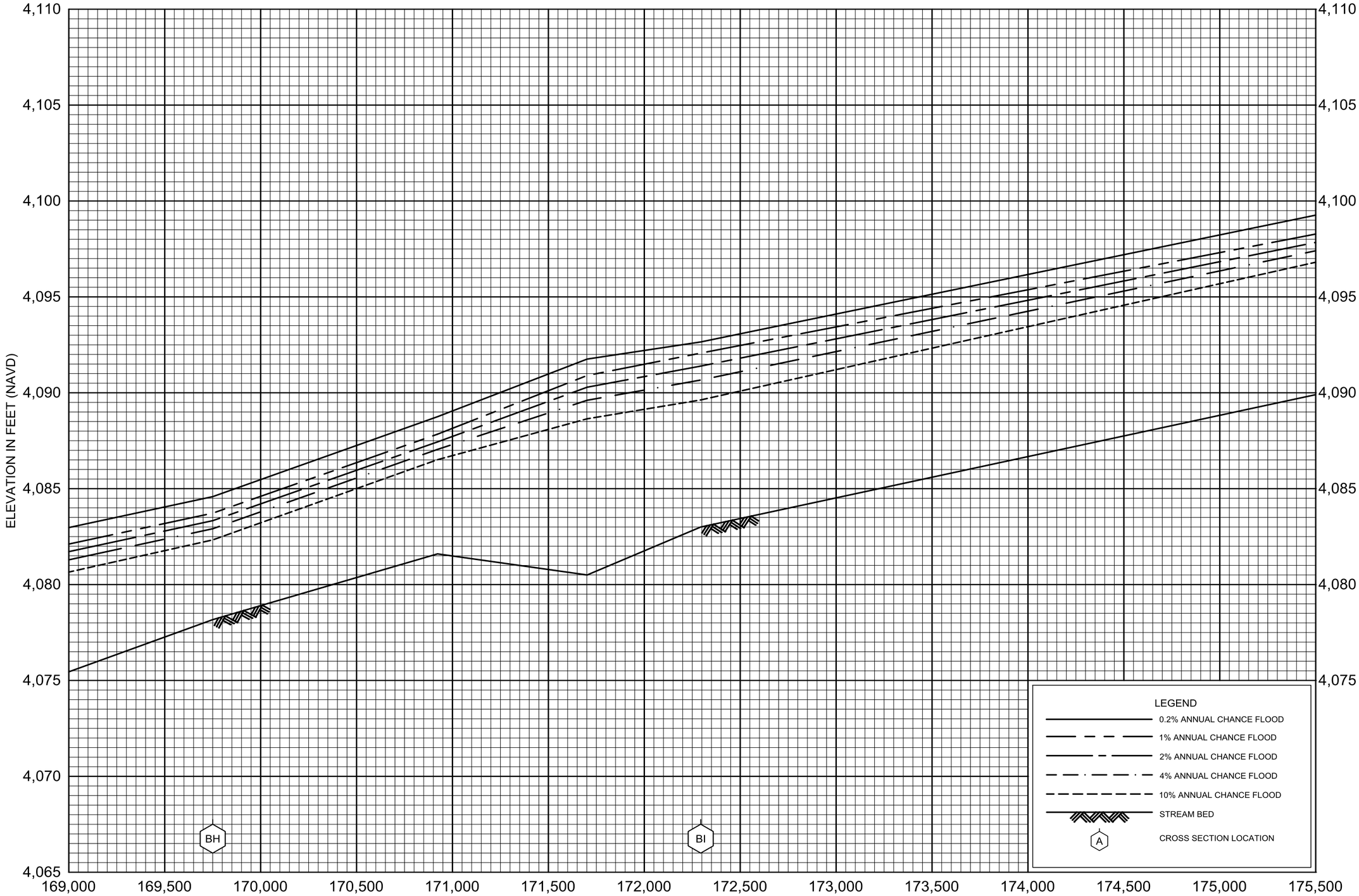
FLOOD PROFILES

MUSSELSHELL RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

WHEATLAND COUNTY, MT
INCORPORATED

34P



FLOOD PROFILES

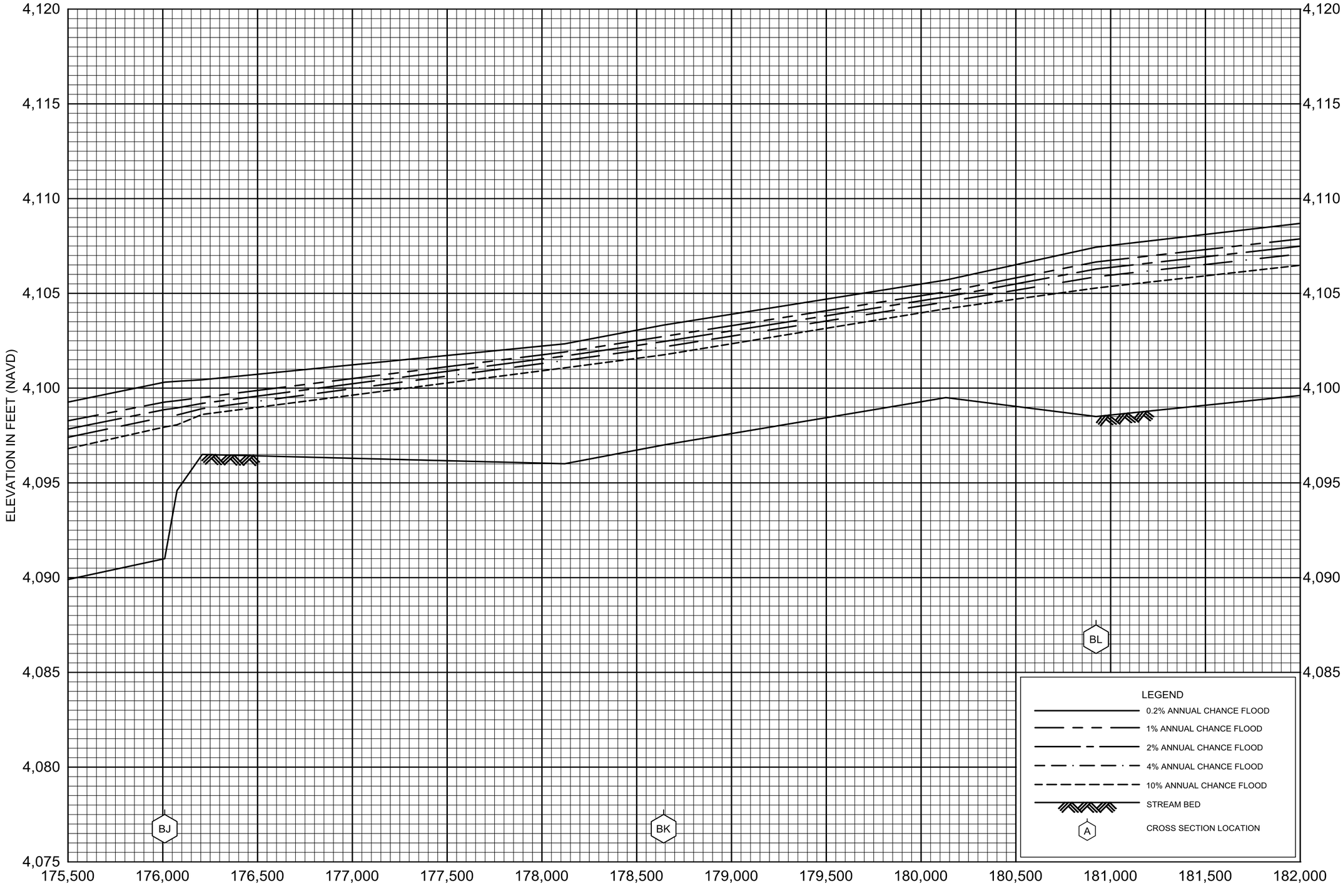
MUSSELSHELL RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

WHEATLAND COUNTY, MT

INCORPORATED

35P



FLOOD PROFILES

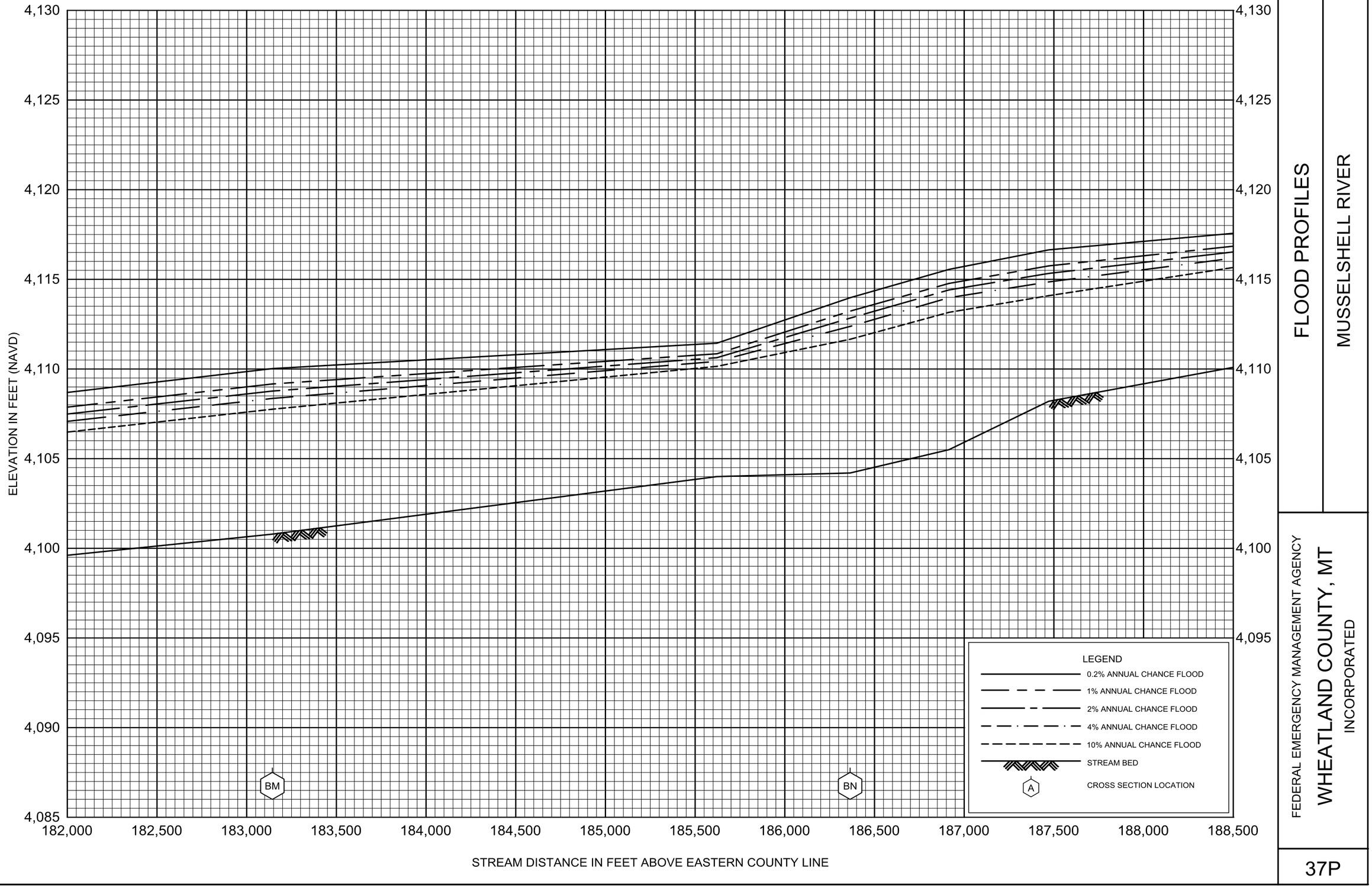
MUSSELSHELL RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

WHEATLAND COUNTY, MT

INCORPORATED

36P



FLOOD PROFILES

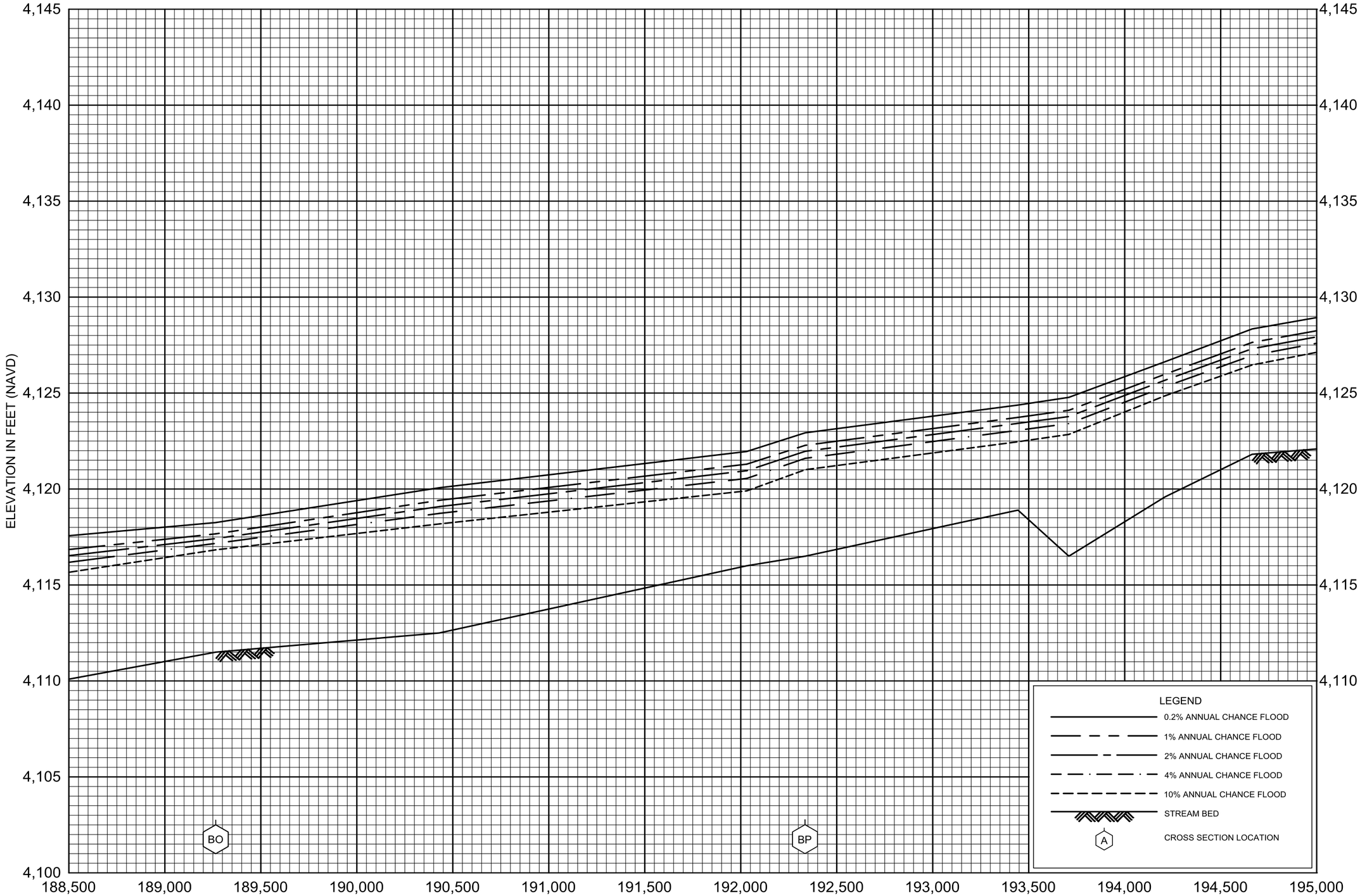
MUSSELSHELL RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

WHEATLAND COUNTY, MT

INCORPORATED

37P



FLOOD PROFILES

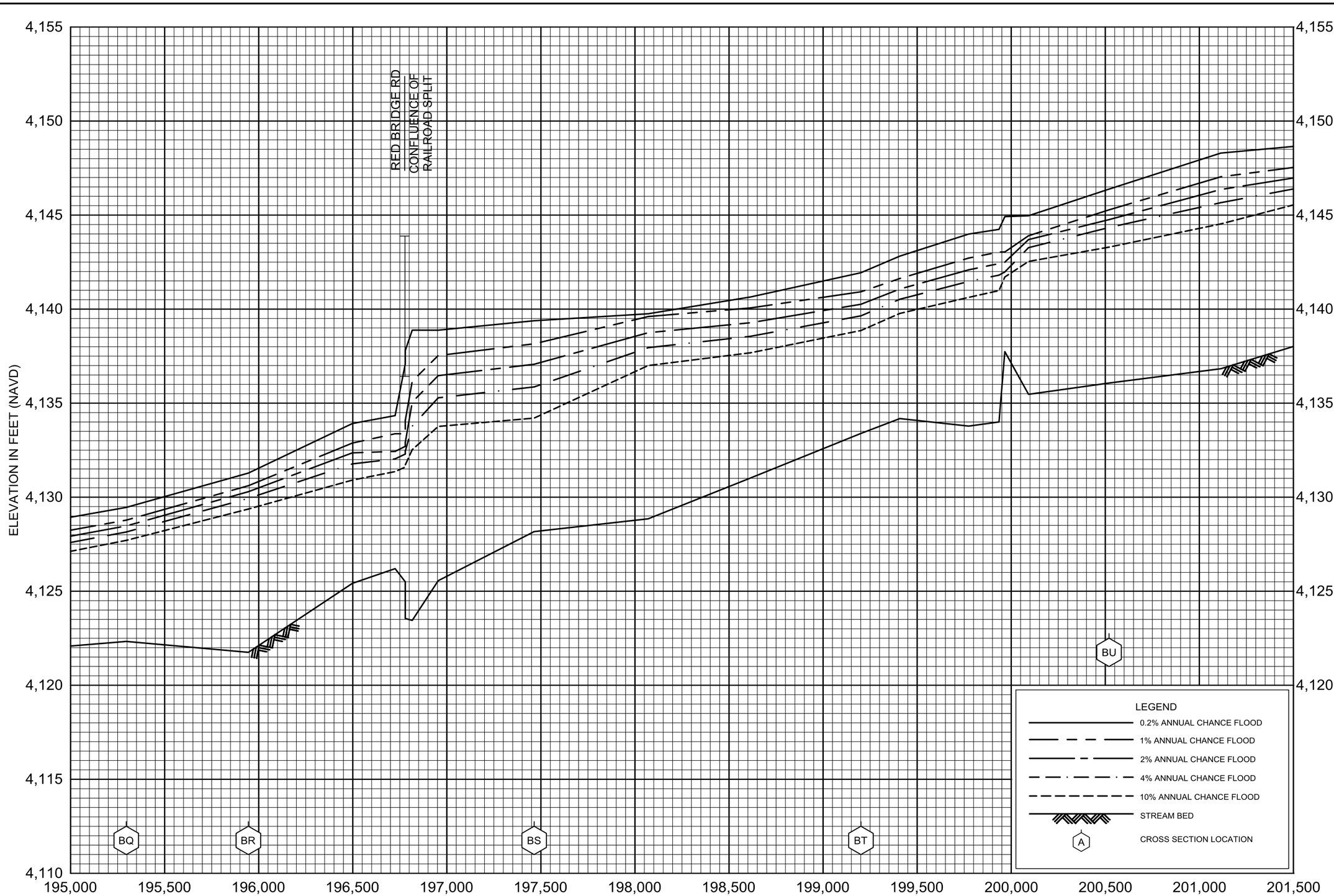
MUSSELSHELL RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

WHEATLAND COUNTY, MT

INCORPORATED

38P



FLOOD PROFILES

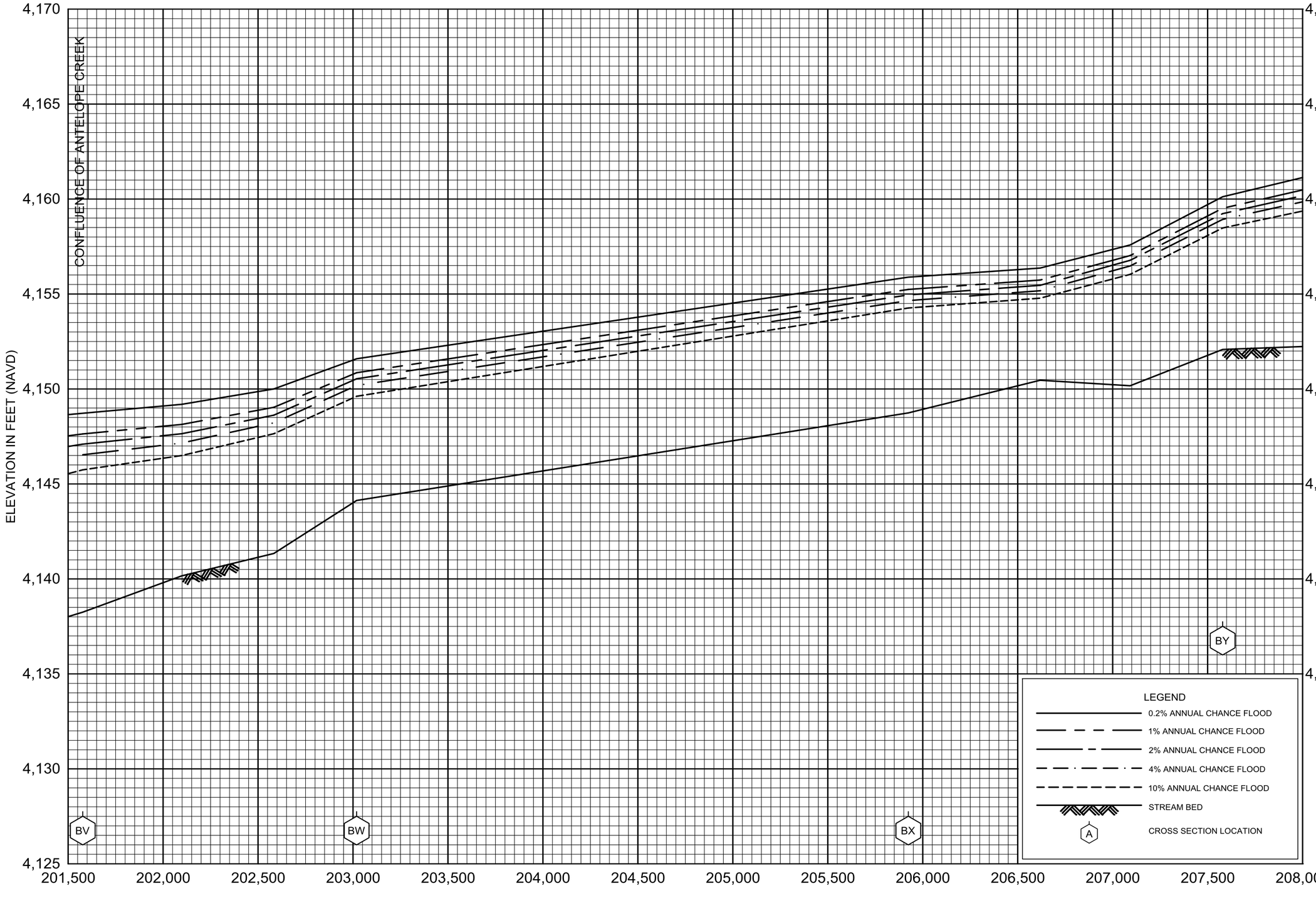
MUSSELSHELL RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

WHEATLAND COUNTY, MT

INCORPORATED

39P



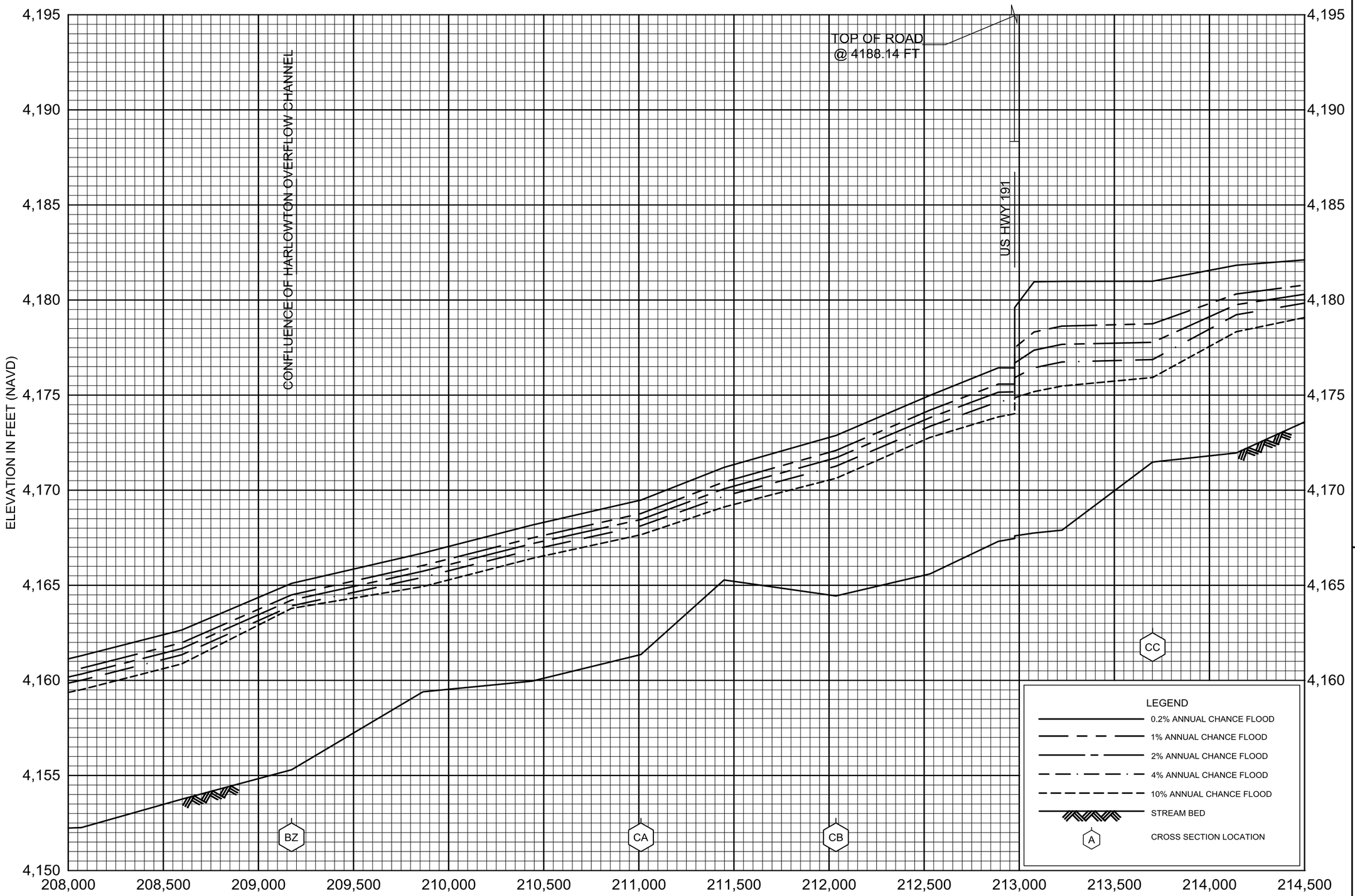
FLOOD PROFILES

MUSSELSHELL RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

WHEATLAND COUNTY, MT

INCORPORATED



FLOOD PROFILES

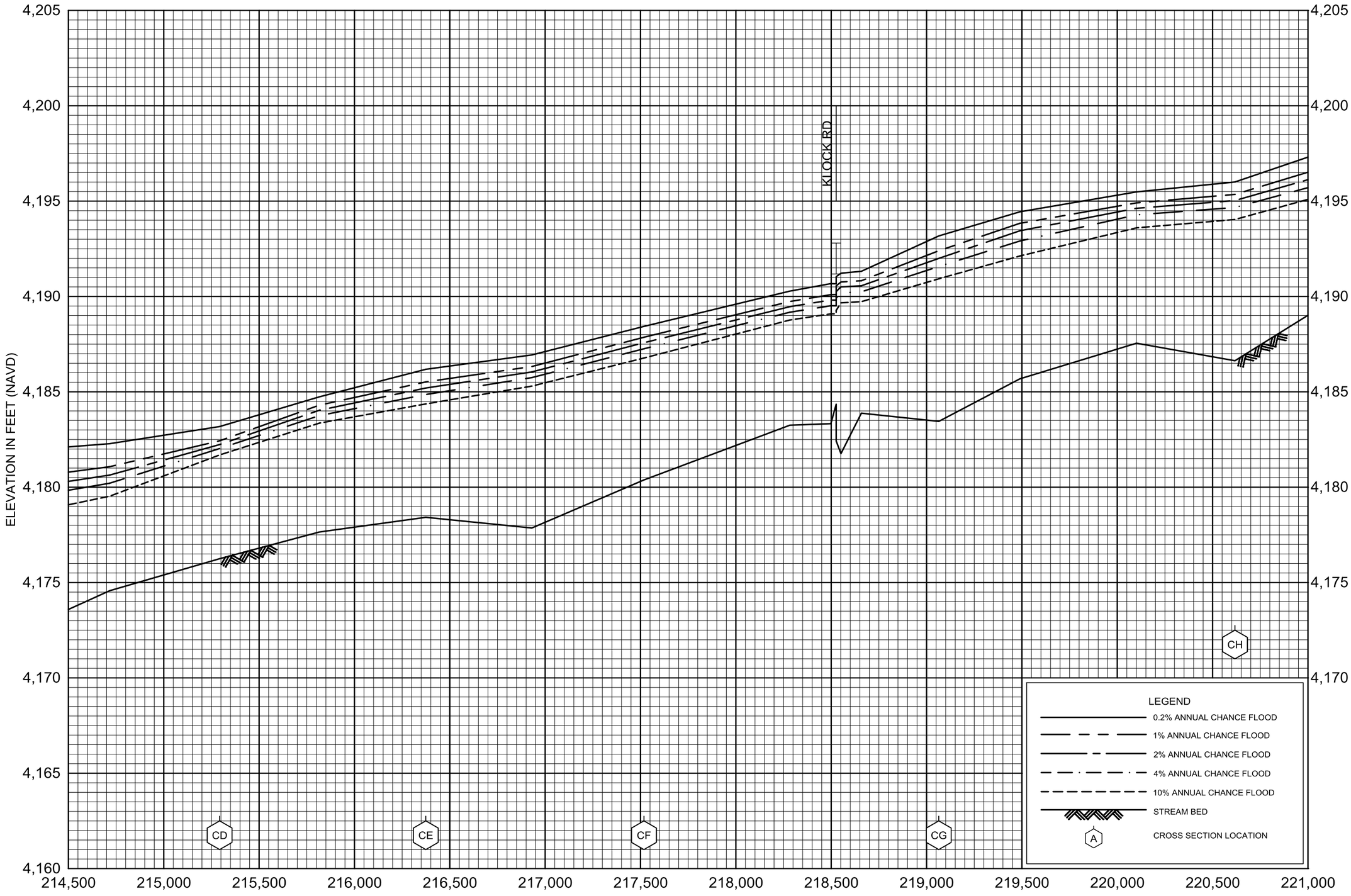
MUSSELSHELL RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

WHEATLAND COUNTY, MT

INCORPORATED

41P



FLOOD PROFILES

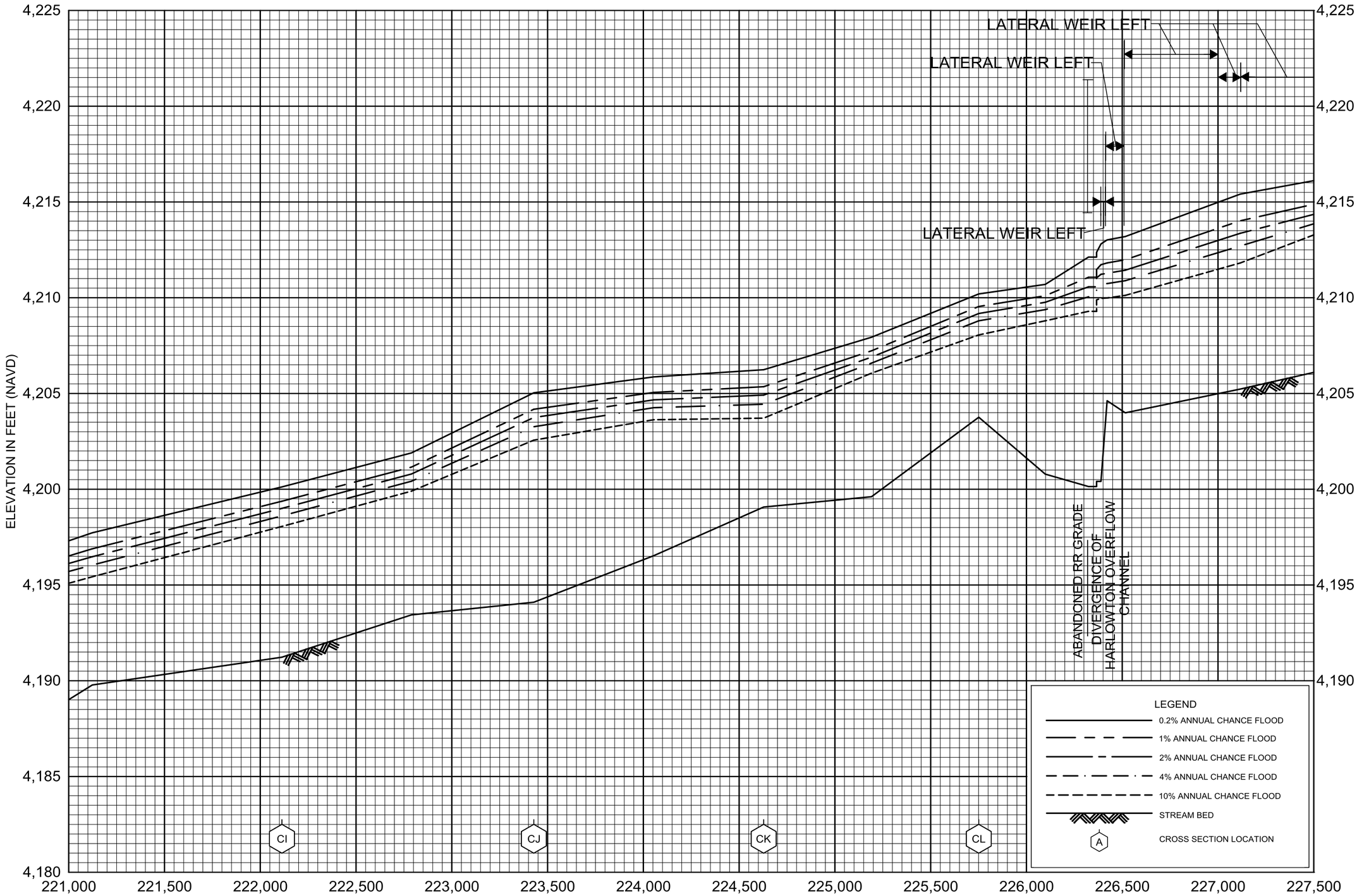
MUSSELSHELL RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

WHEATLAND COUNTY, MT

INCORPORATED

42P



FLOOD PROFILES

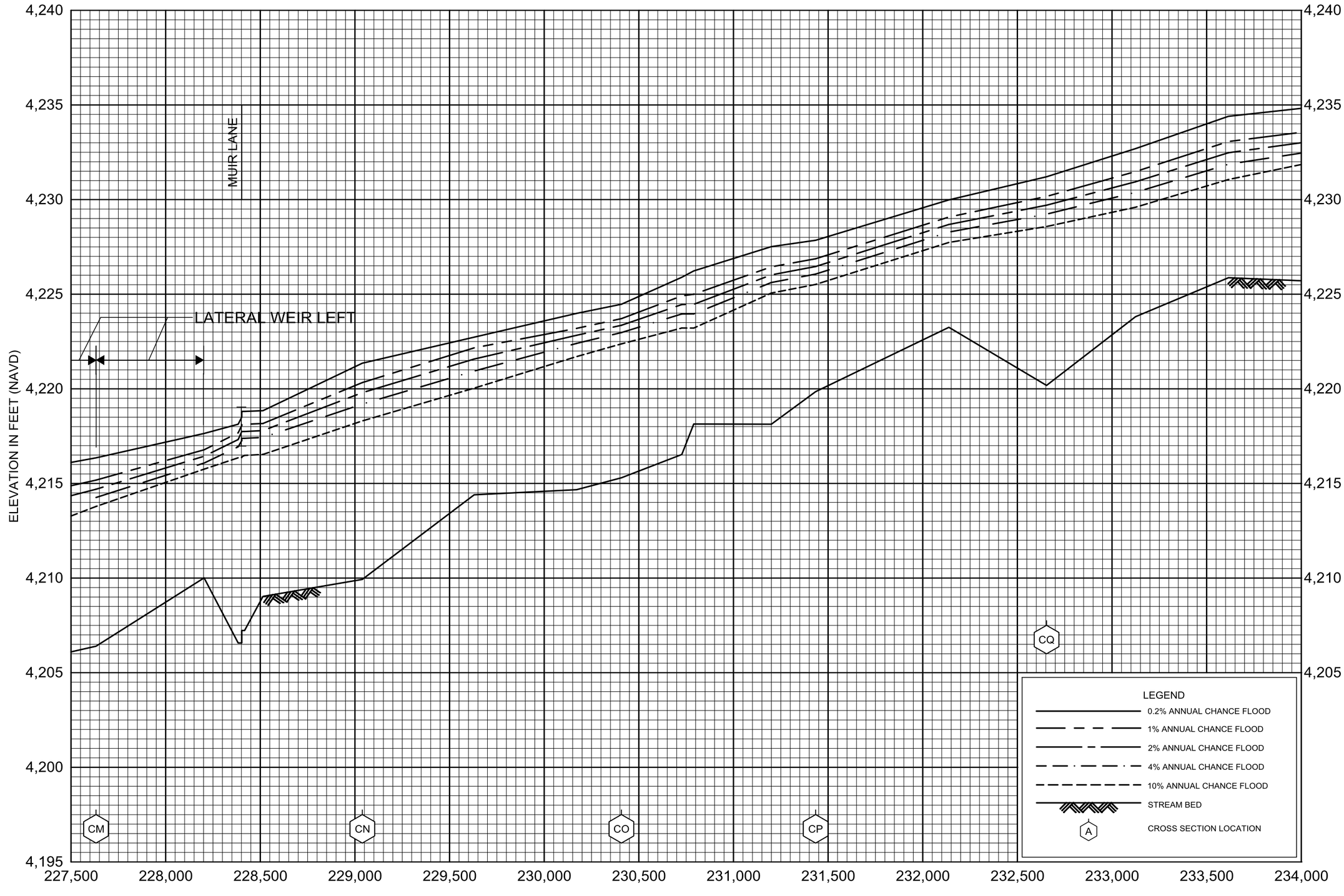
MUSSELSHELL RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

WHEATLAND COUNTY, MT

INCORPORATED

43P



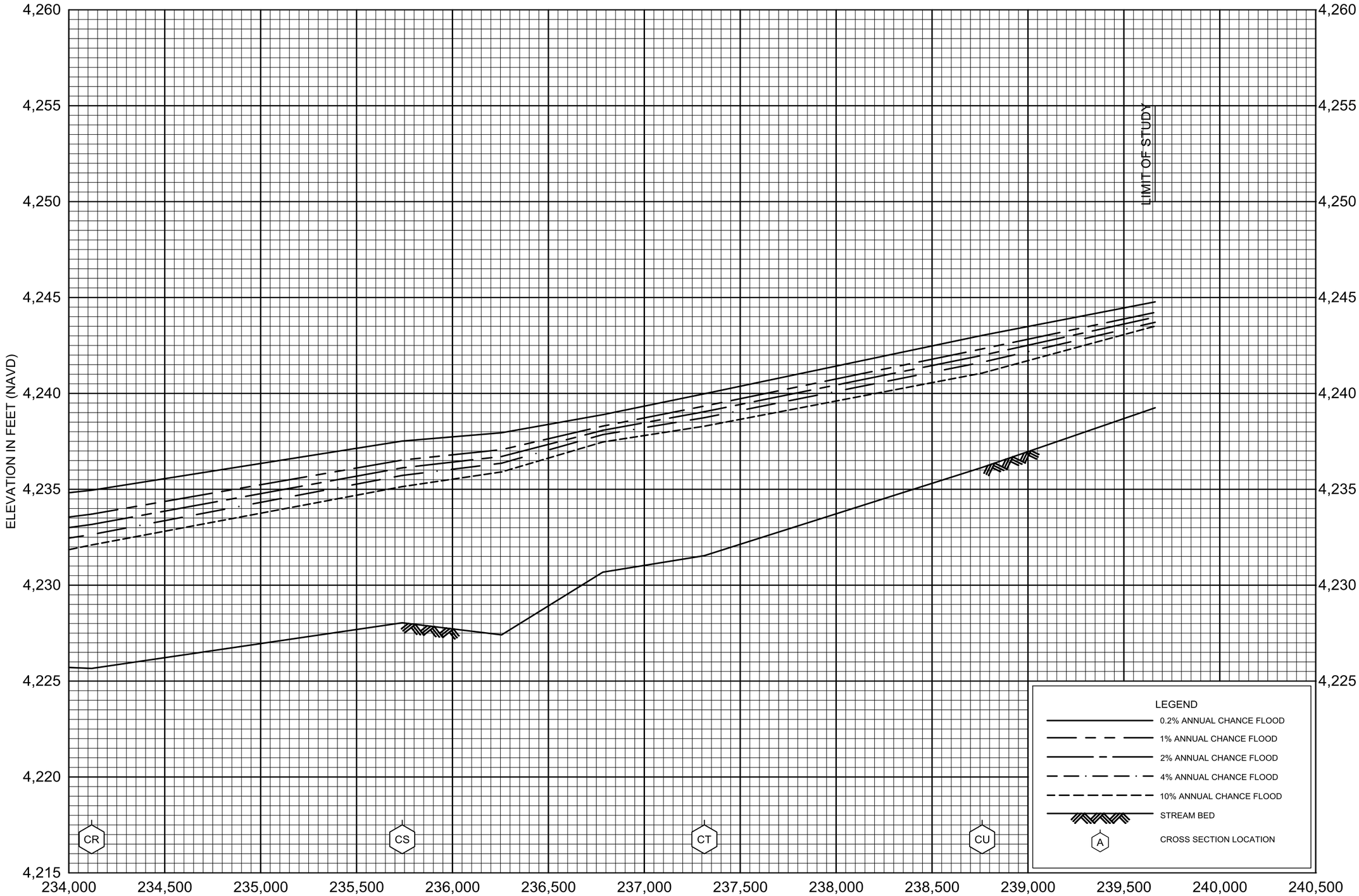
FLOOD PROFILES

MUSSELSHELL RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

WHEATLAND COUNTY, MT

INCORPORATED



FLOOD PROFILES

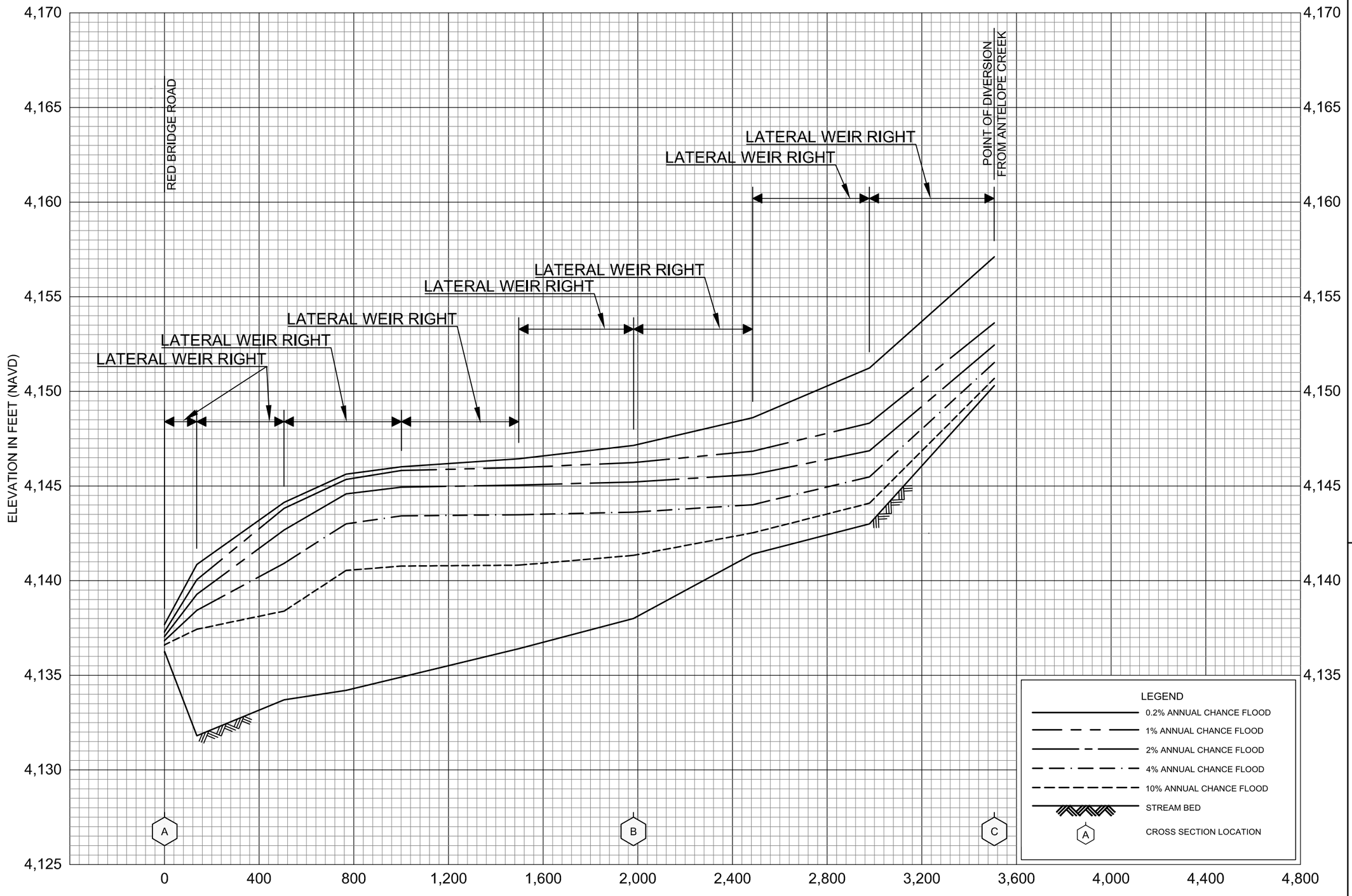
MUSSELSHELL RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

WHEATLAND COUNTY, MT

INCORPORATED

45P



FLOOD PROFILES

RAILROAD SPLIT

FEDERAL EMERGENCY MANAGEMENT AGENCY

WHEATLAND COUNTY, MT

AND INCORPORATED AREAS